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EDITED BY THURSTON SCOTT WELTON, M.D.

August 1945

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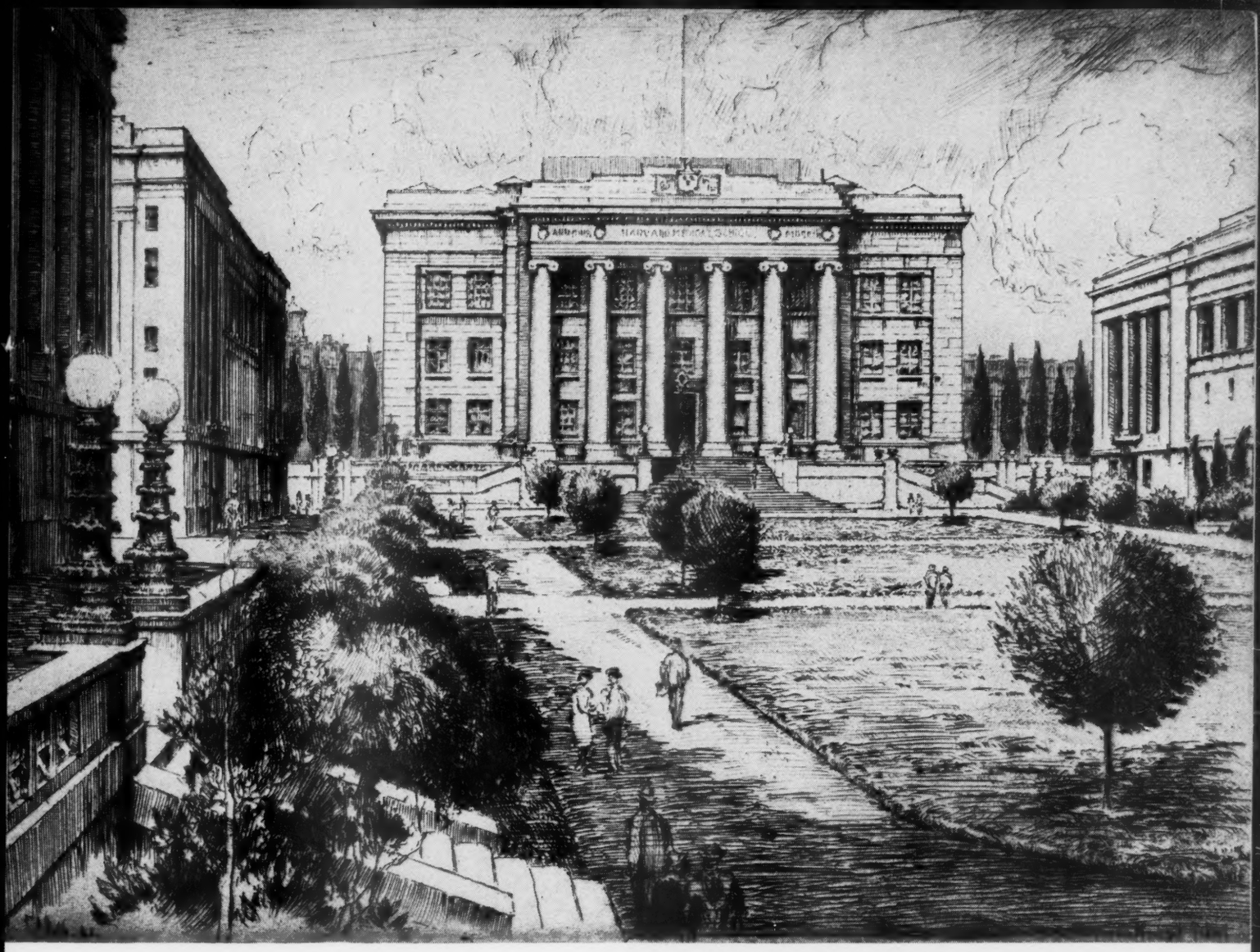


FROM AN ORIGINAL ETCHING BY ERNEST D. ROTH, N. A.

THE HARVARD SCHOOL OF MEDICINE was started as a branch of the University at Cambridge, Massachusetts, in 1782 and moved to Boston in 1810 to be near the growing hospital facilities of the city. Today the modern buildings of the Harvard School of Medicine are surrounded by some of Boston's largest and finest hospitals, which offer almost unlimited opportunities for clinical teaching and investigation. Many distinguished surgeons and physicians were graduated from this famous school.

Experience is the foundation on which all successful careers in the surgical and medical world are built. It is also the basis on which progress is made in the production and improvement of surgical sutures. D&G has gained long and valuable experience through its thirty-seven years of specialization in this field, and as a result has been able to make many important advances in suture quality. D&G research and product development are constantly contributing to new and finer techniques in surgery. Illustrated and described on the following pages are a few phases of D&G's broad service in sutures.

Incisions that Minimize Wound Disruption

AN IMPORTANT ADVANCE IN THE TECHNIC OF SUTURING

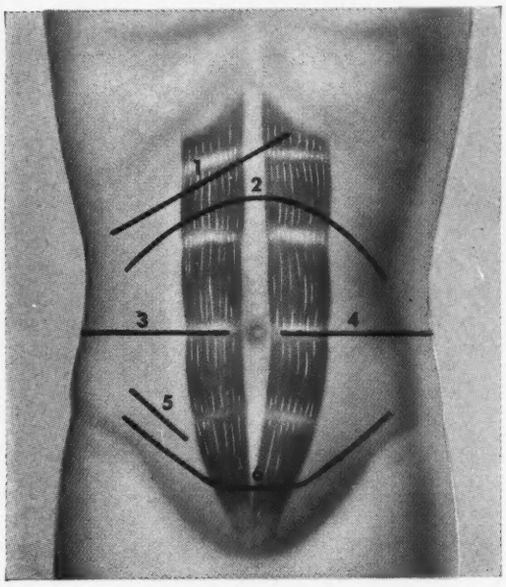
The employment of operative incisions which offer maximal assurance against sutures pulling through the tissues eliminates one of the principal causes of wound disruption and lessens the possibility of post-operative herniation.

Sutures hold most securely if the connective tissues within the wound are approximated in such a manner that the sutures must pull against the fibres within these layers. This necessitates cutting the connective tissues parallel to the direction of their fibres which, in the anterior abdominal wall, is usually best accomplished through a transverse initial skin incision.

In the past, transverse abdominal incisions have not found wide acceptance because they necessitate cutting across muscles in which sutures hold poorly and almost invariably cause tissue necrosis.

In the new technic of suturing transverse incisions, no attempt is made to suture muscle —only the surrounding sheath. Approximation of the muscle edges is further aided by keeping the patient in a semi-reclining position with knees partially flexed.

Because of the favorable results attending increasing use of this technic, and the current interest in principles which may facilitate early ambulation, D&G presents a series illustrating the incisions, and methods of suturing them.



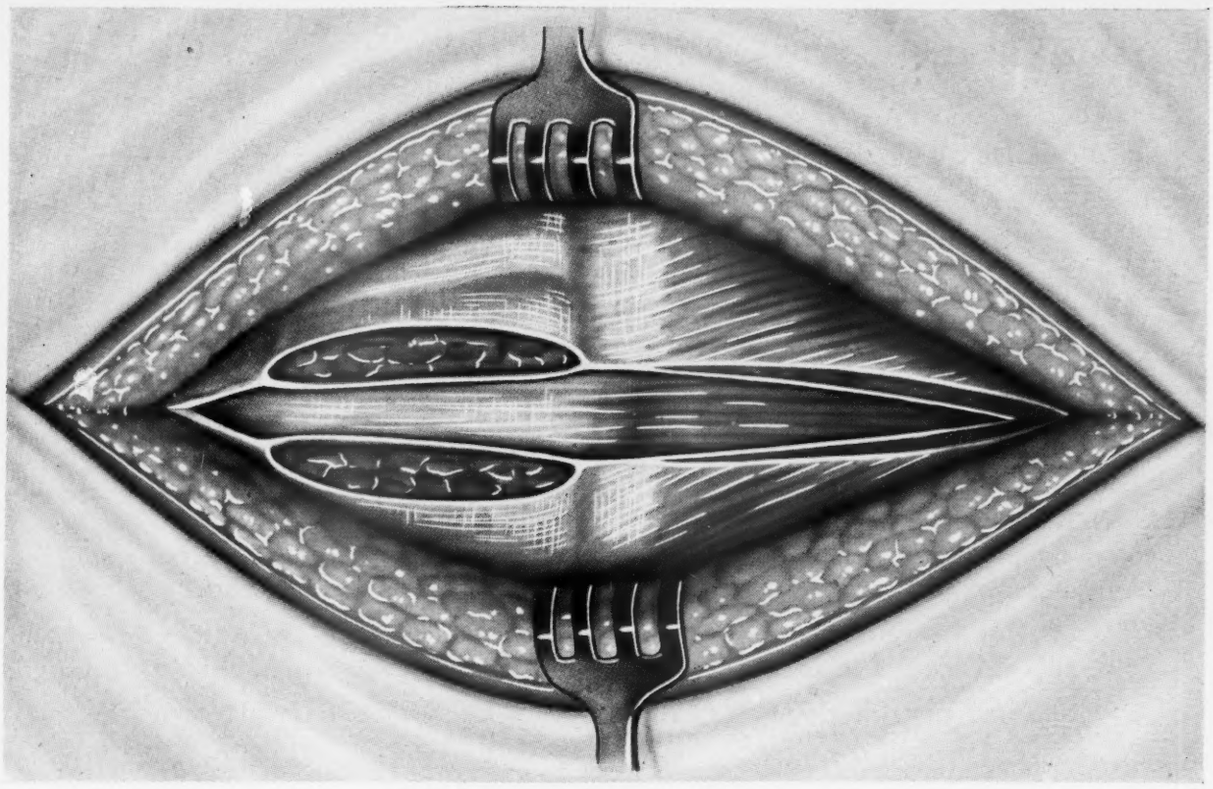
1. For gall bladder, common duct, head of pancreas.
2. Resection of stomach, transverse colon.
*3. Resection of ascending colon, cecum, right sided lesions.
*4. Descending colon, spleen and left sided lesions.
5. Appendectomy.
6. Pelvic surgery, resection of sigmoid.

NUMBERS THREE AND FOUR OF A SERIES

*RESECTION OF ASCENDING AND DESCENDING COLON

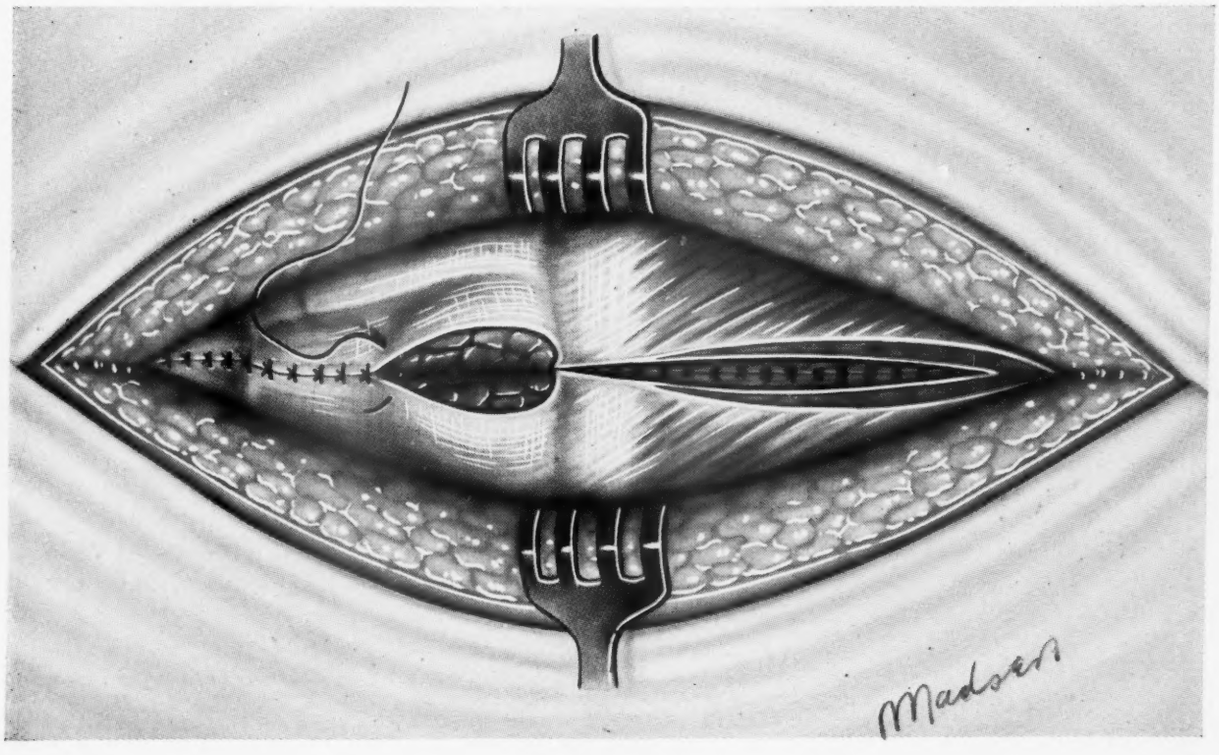
The incision shown (4) is being made on the left exposing the descending colon and sigmoid. To expose the cecum and ascending colon a similar incision (3) can be made on the right.

The skin incision extends from the linea alba to the angle between the ribs and the crest of the ilium. After the subcutaneous fat is cut the anterior rectus sheath is split in the direction of its fibres. The rectus muscle is divided at right angles. Two or three large bleeders must be clamped and ligated within the muscle. The inferior epigastric vessels are divided between clamps and ligated. The posterior sheath and peritoneum are cut in the direction of the fibres of the sheath. The entrance into the peritoneal cavity is usually made toward the midline and then the incision is extended laterally into the internal oblique. An excellent exposure of the lumbar gutter is obtained, particularly if the patient is tilted toward the opposite side.



The peritoneum and posterior sheath are approximated first with interrupted sutures. The rectus muscles are not sutured, although the fasciae of the internal oblique are caught in the suturing of the posterior and anterior sheaths. The anterior sheath is closed with interrupted sutures. The sutures pull against the fibres of both the anterior and posterior sheaths giving strength to the wound. The skin is closed in the usual manner.

When required, a drain is brought out at the lateral angle of the wound.



Sutures for Every Surgical Situation

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SURGERY OF THE EYE

Prominent among the achievements of D&G research and pioneering has been the application of the atraumatic principle to suture needle combinations in the minute sizes required for eye surgery.

This achievement which less than a decade ago appeared to present insurmountable difficulties has led to the development of suture needle combinations for all types of eye surgery. These now comprise fine sizes of Anacap Silk and Claustro-Thermal Catgut armed with swaged-on atraumatic needles.

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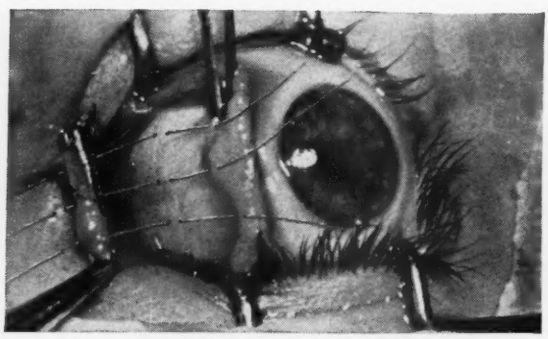
The wide range of suture needle combinations which D&G has developed and made available has aided the progress of ophthalmic surgery by extending to this field the atraumatic principle which among other advantages reduces trauma to an absolute minimum.



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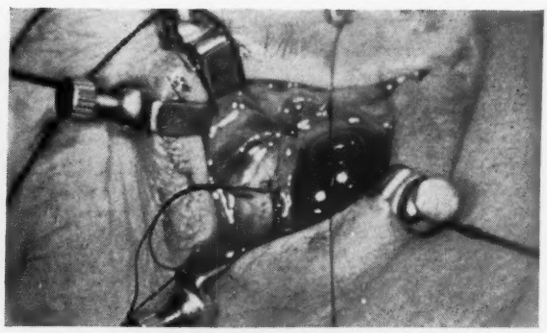

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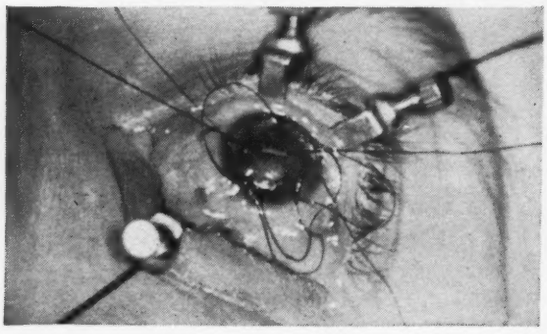

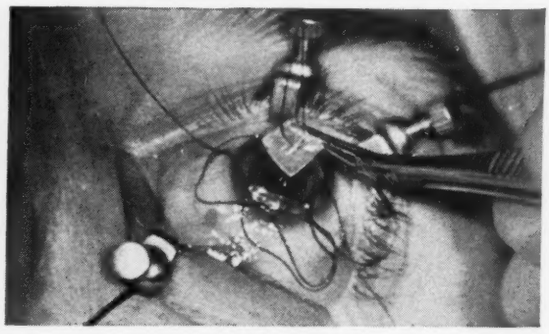

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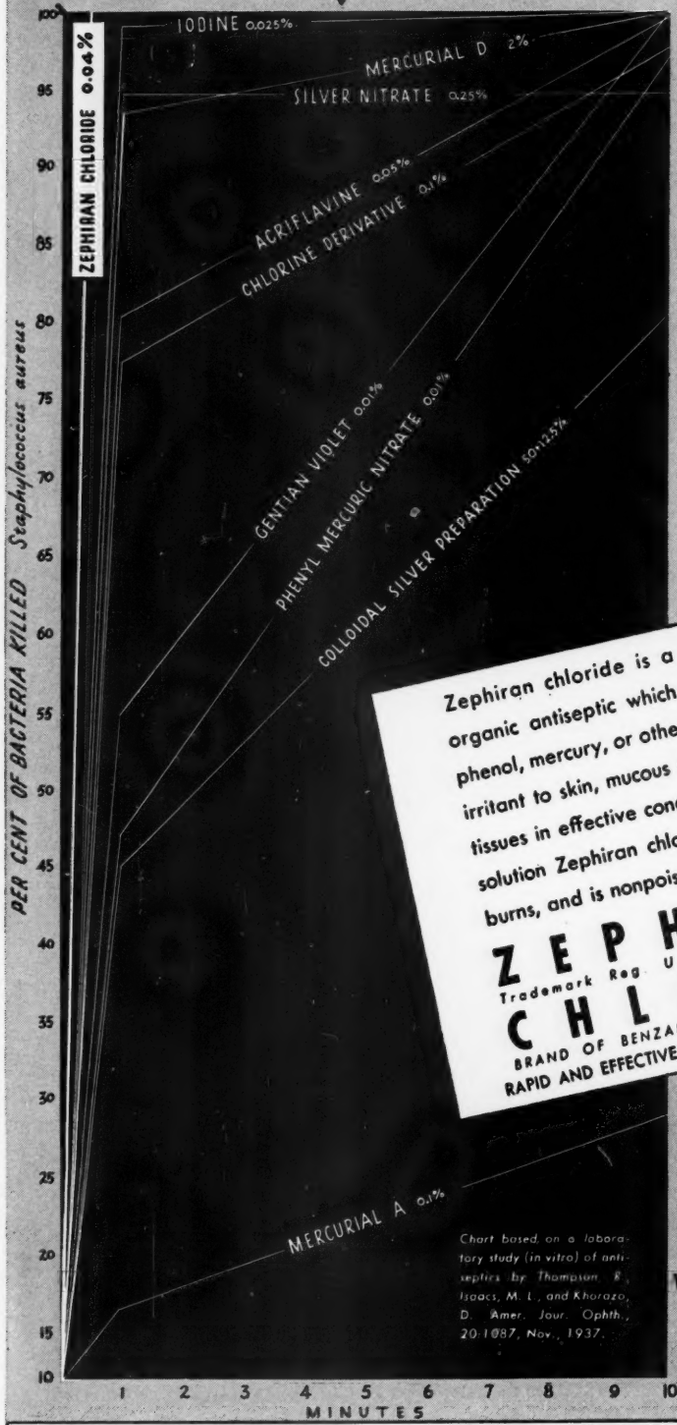
THE SPEED AND EFFECTIVENESS OF 10 ANTISEPTICS IN COMMON USE



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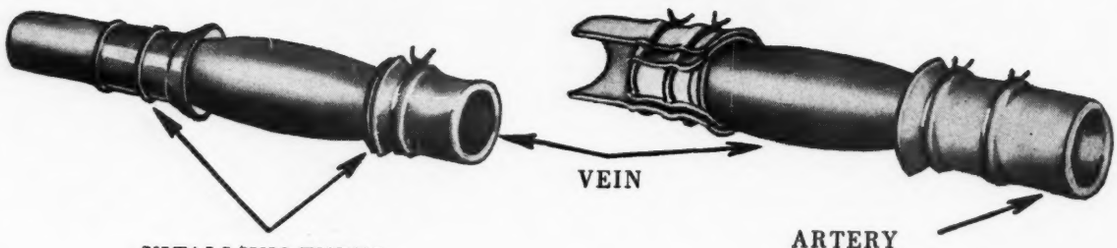

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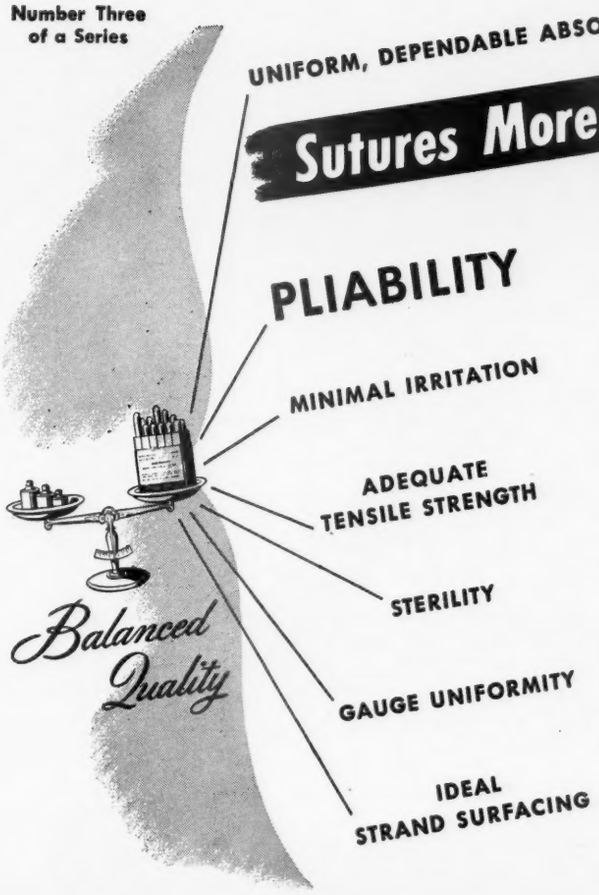

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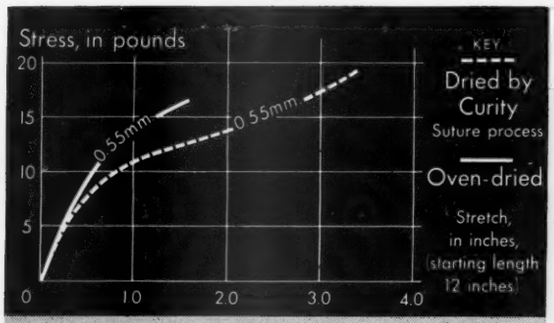

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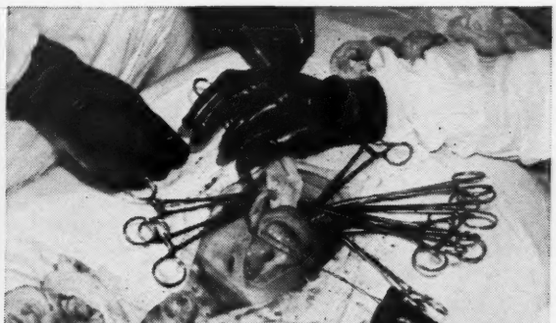

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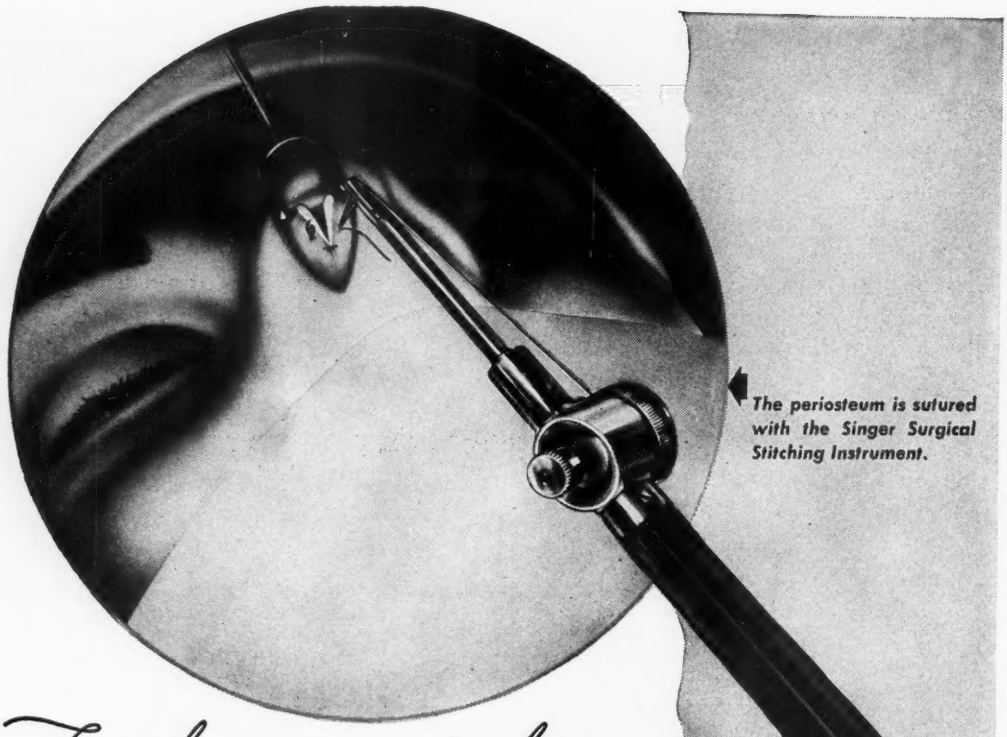

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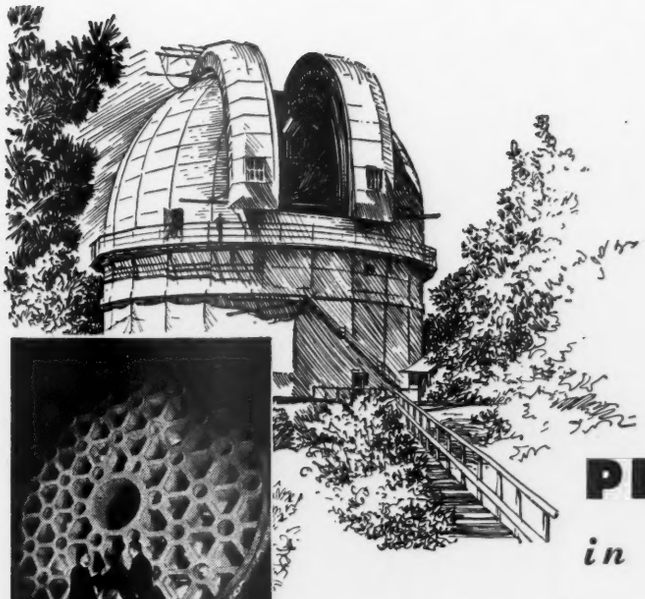

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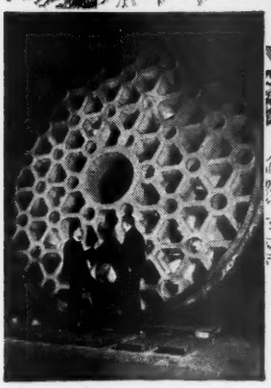

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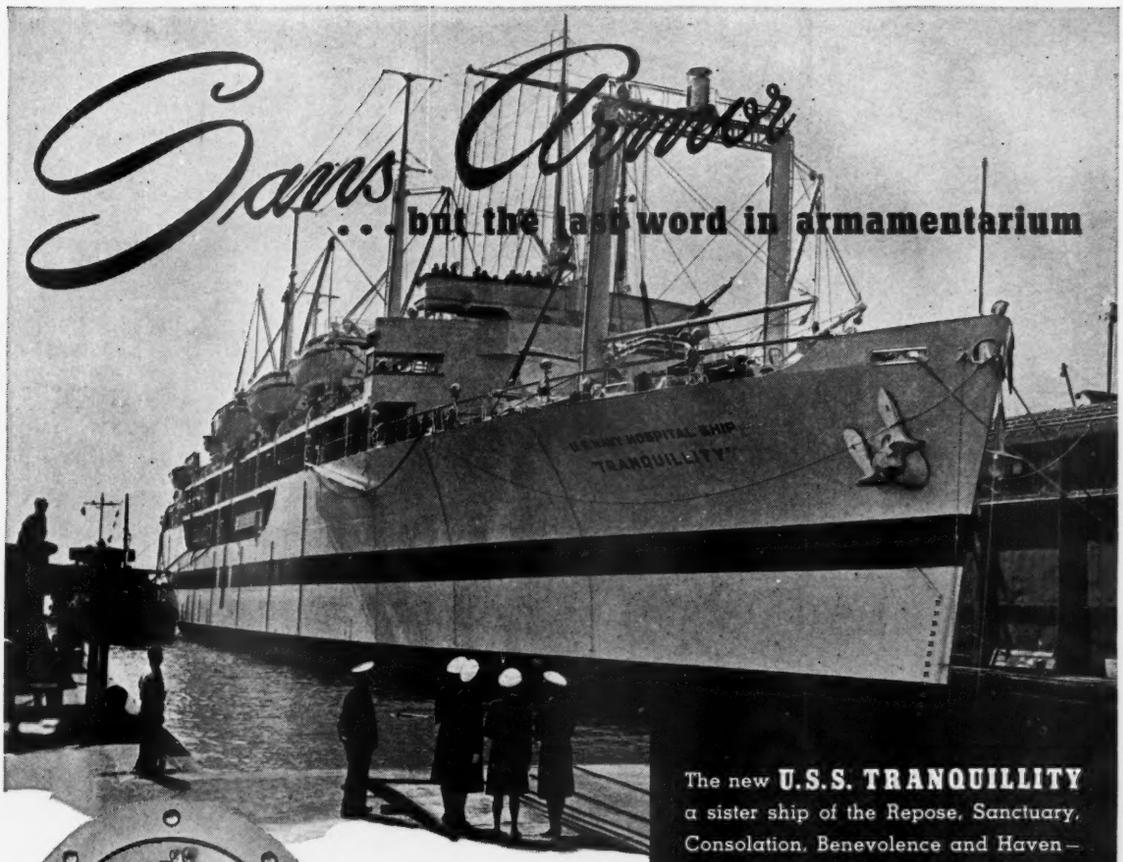

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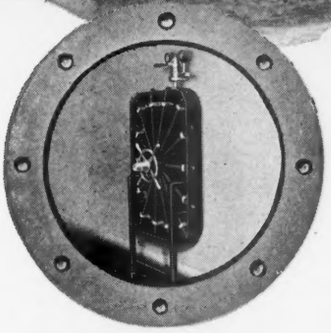

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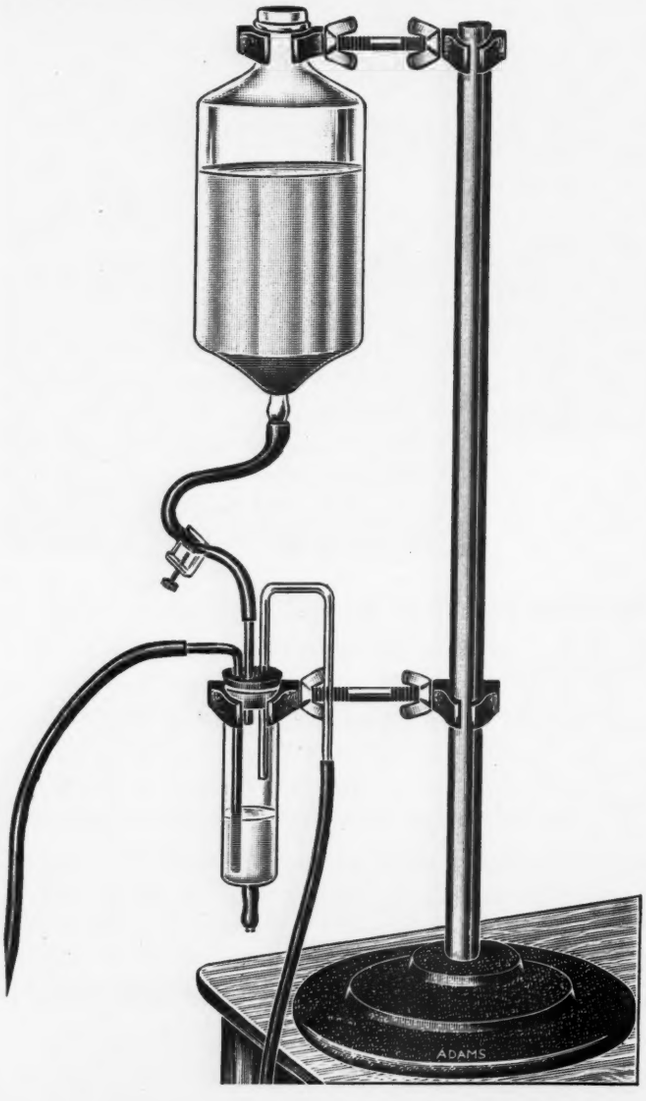

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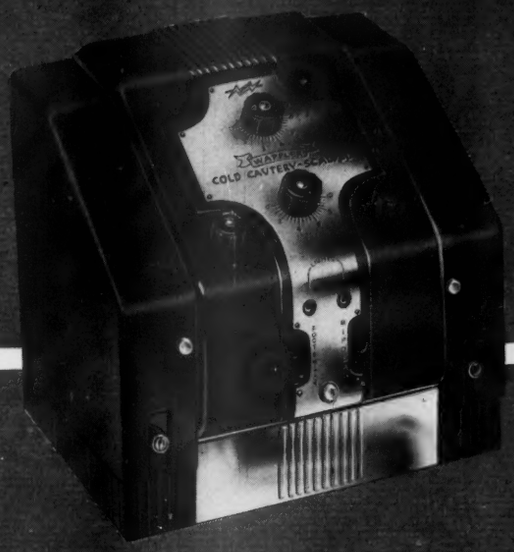

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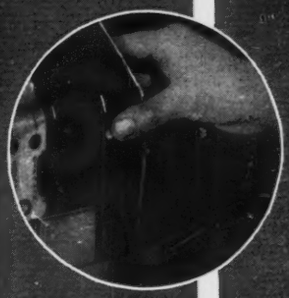

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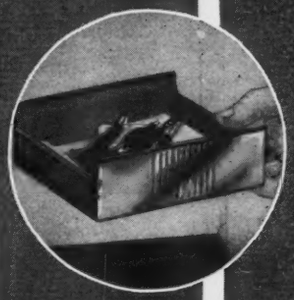

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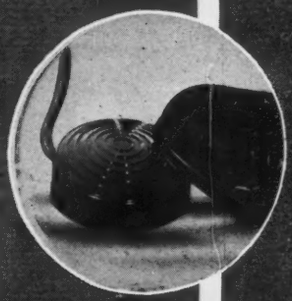

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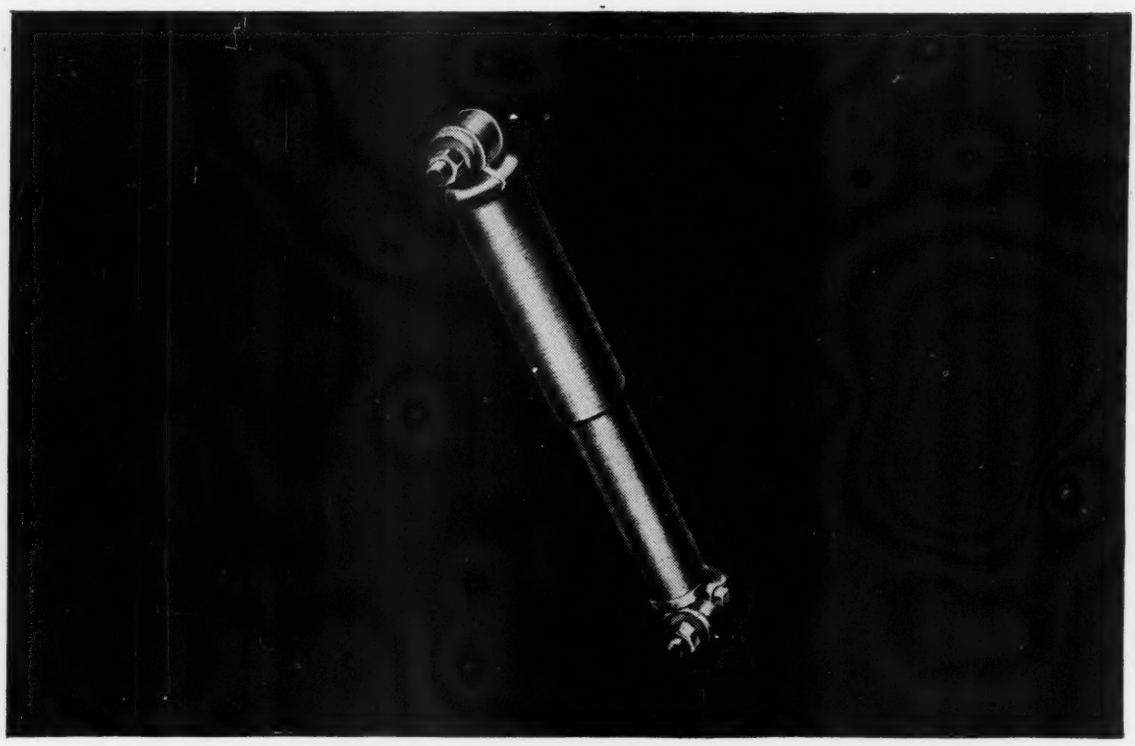

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*Brougher, John C.: West. J. S. O. & G. 52:520-521 (Dec.) 1944

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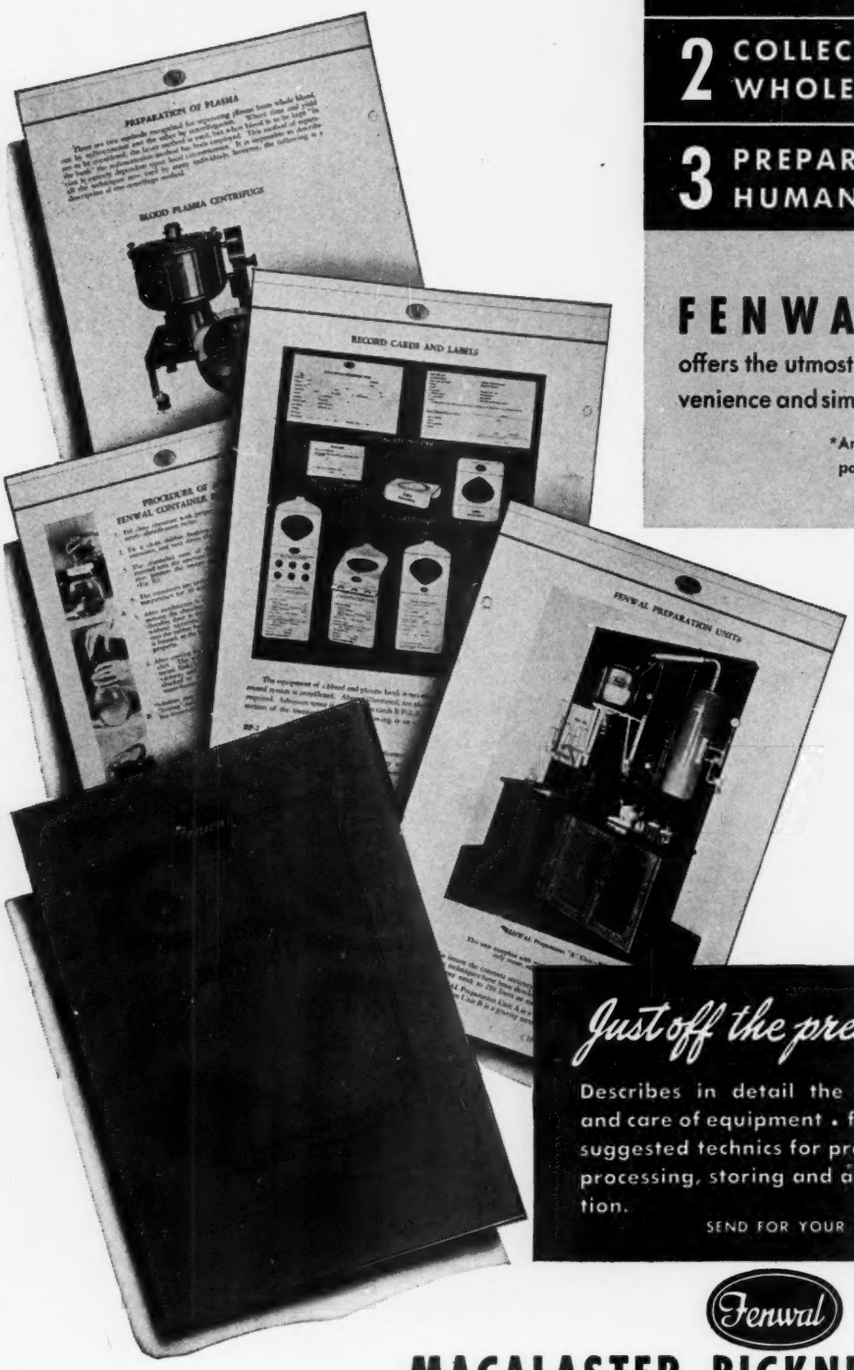

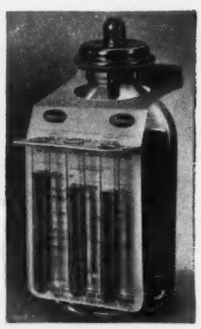

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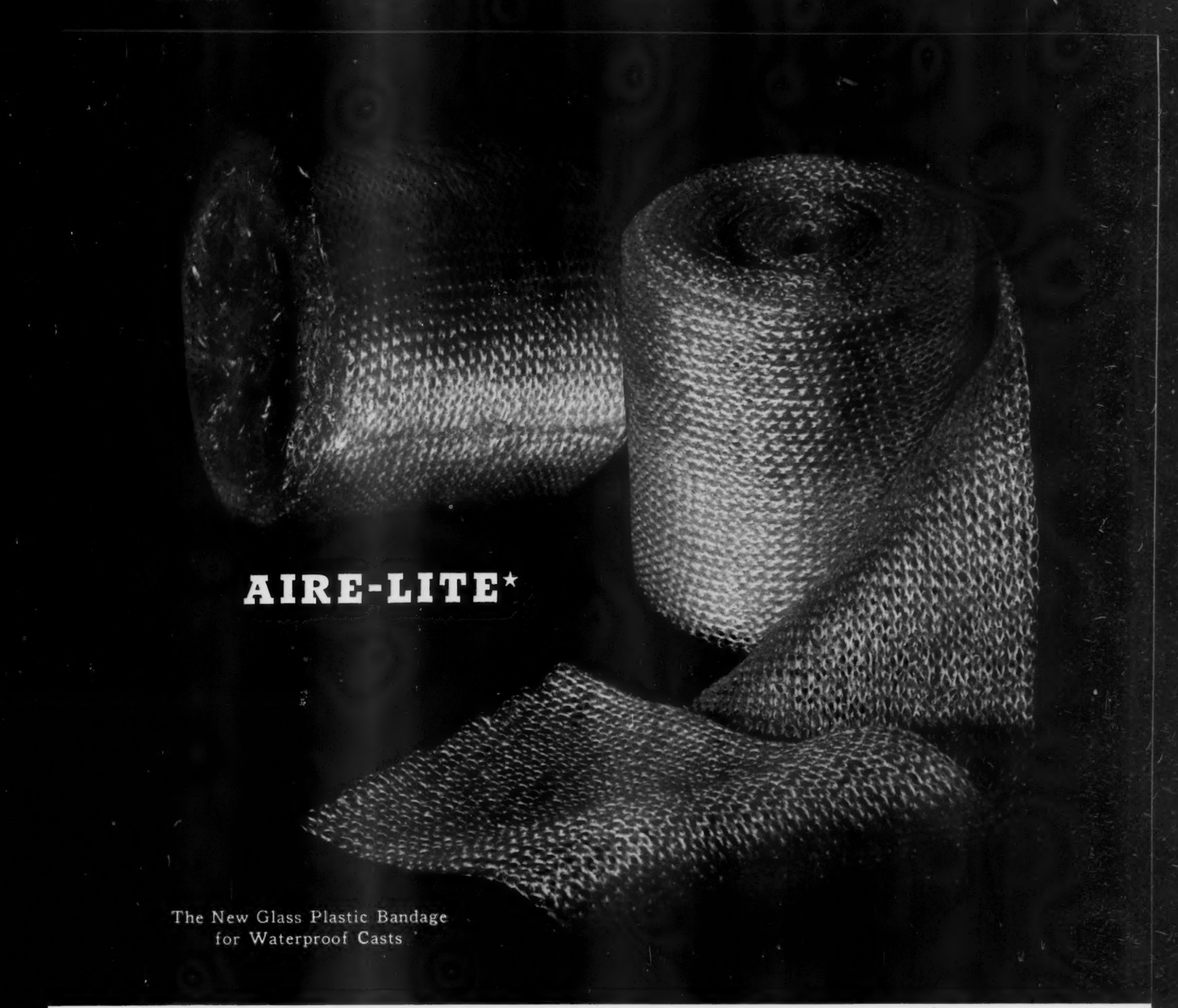

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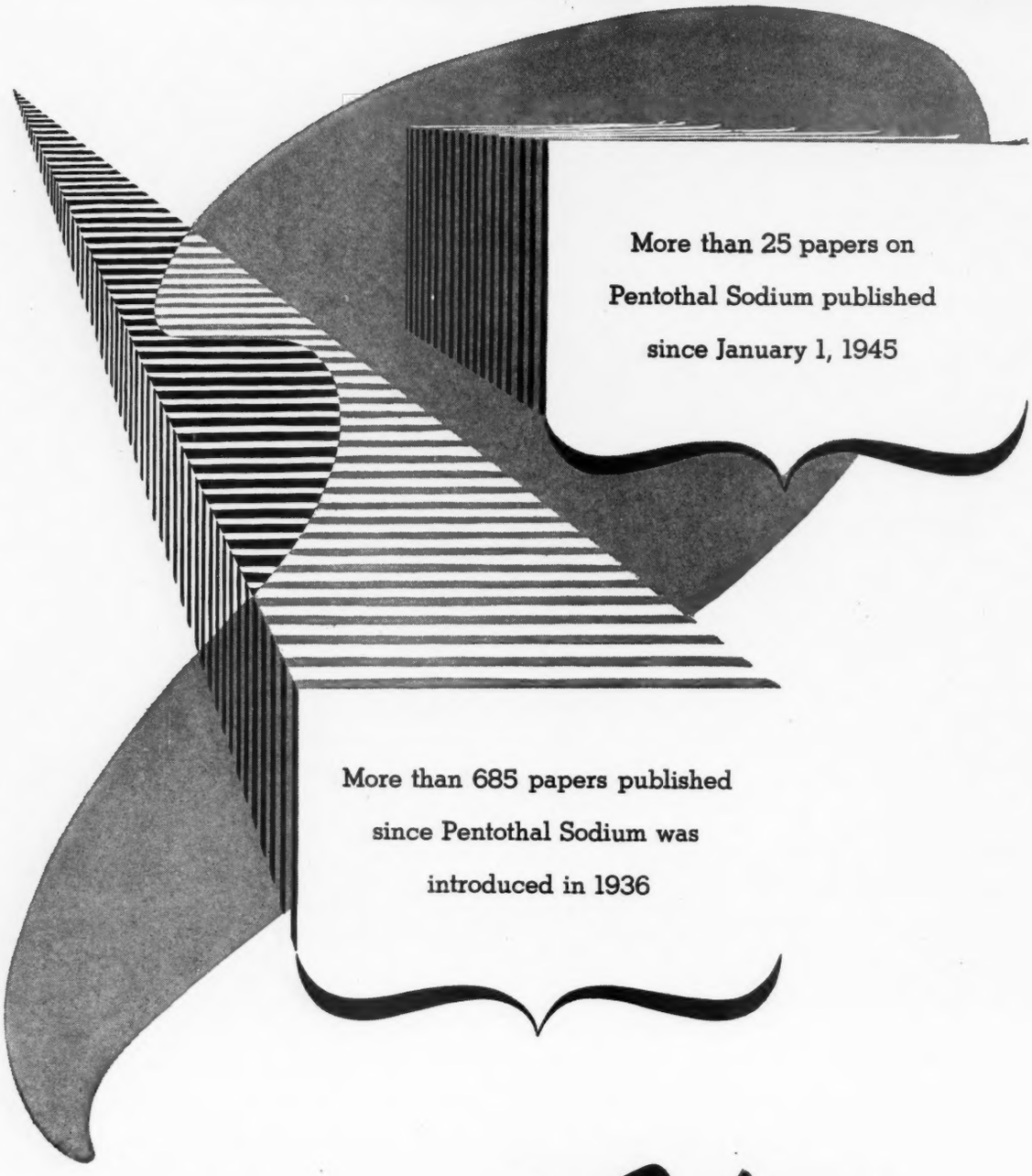
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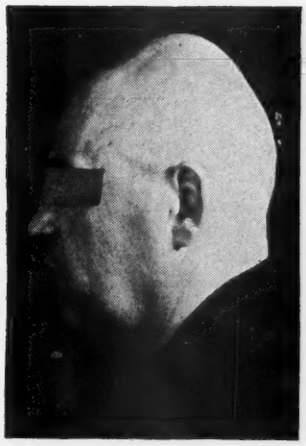
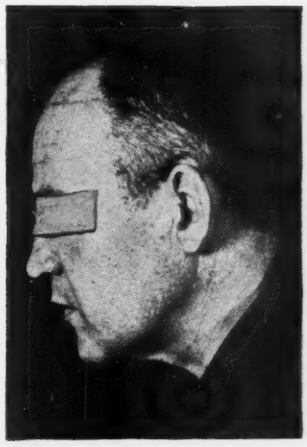


Lateral view of patient before operation for insertion of tantalum implant.



Lateral view of patient after operation.

"THE importance of the repair of defects of the skull has not been sufficiently stressed in the past," says W. James Gardner, of the Cleveland Clinic.†

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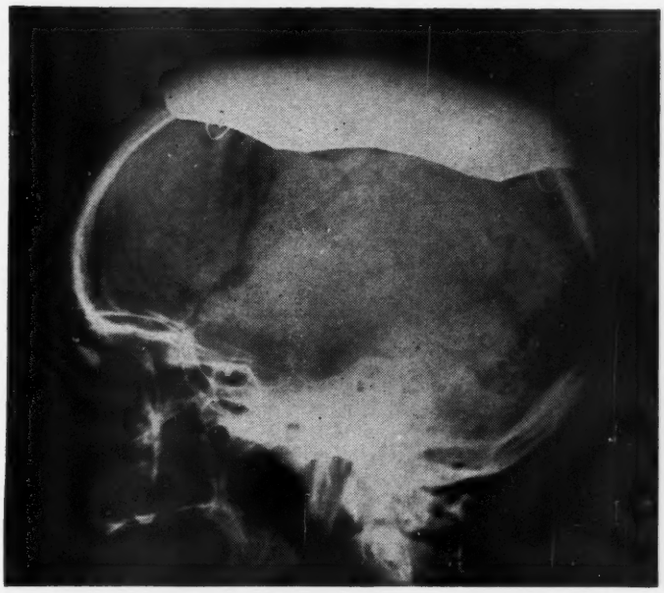
• For skull repair, tantalum is supplied in sheets, wire, and sutures. Literature on request.

† Gardner, W. James, M. D., F. A. C. S., "Closure of Defects of the Skull with Tantalum," S. G. & O., 80: 303, March, 1945.



Postoperative roentgenogram of patient shown above.

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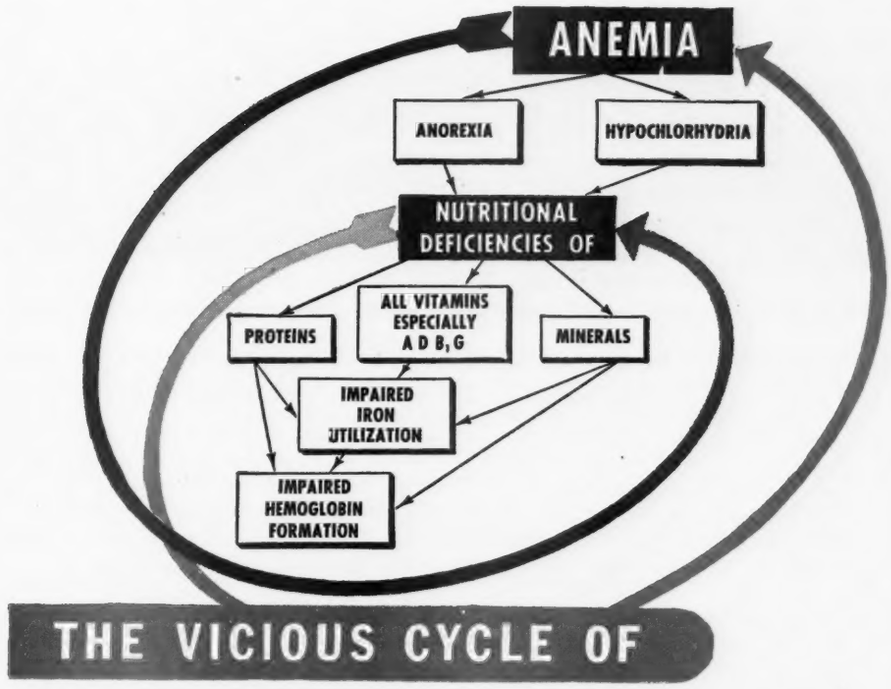

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Patients with hypochromic anemia resulting from nutritional deficiencies or blood loss exhibit one common feature: With anemia once established, the ensuing reduction of gastric acidity, lack of appetite, and increased fatigability tend to decrease further the food intake, thus promoting or intensifying nutritional deficiencies and the progress of anemia.

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together with liver concentrate (vitamin fraction), derived from 4 grams of fresh liver, and dried brewers' yeast.

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DURING the course of any infectious process the release of organisms into the blood stream and the development of metastatic foci are a constant threat. Before the advent of penicillin, bacteremia had to be regarded as a grave prognostic sign since distant secondary foci were apt to be established before the organisms could be eradicated from the blood. Penicillin, as the reports presented show, has improved this outlook. Used early and in adequate dosage, it has proved successful in combating this complication when caused by susceptible organisms. Usually it produces rapid response, leading to sterilization of the blood stream and to marked improvement or complete disappearance of the original infectious process.

An excellent result was obtained in a case of hemolytic streptococcic septicemia which had led to a localized embolic abscess of the lung. A total dosage of 600,000 O.U. of penicillin was administered intramuscularly at the rate of 20,000 O.U. every 3 hours.

Larsen, N. P.: Observations with Penicillin, Hawaii M. J. 3:372 (July-Aug.) 1944.

•

In 57 cases of staphylococcic bacteremia penicillin effected improvement usually within 48 hours and led to clinical recovery within 3 to 7 days. In most of these cases the improvement brought about in the patient's condition permitted postponement of surgical treatment of localized foci until the acute septic phase had passed. Penicillin was administered by continuous intravenous drip, 60,000 O.U. to 150,000 O.U. in each 24-hour period.

Lockwood, S. J.; White, W. L., and Murphy, F. D.: The Use of Penicillin in Surgical Infections, Ann. Surg. 120:311 (Sept.) 1944.

•

An 11 months old child with hemolytic streptococcic septicemia and bronchopneumonia developed serious kidney complications during sulfadiazine therapy, but recovered rapidly on penicillin (300,000 O.U. administered intramuscularly).

A patient with staphylococcic septicemia secondary to a leg abscess, who had relapsed after initial improvement under sulfadiazine and staphylococcus antitoxin therapy, recovered rapidly on a total dosage of 500,000 O.U. given intravenously.

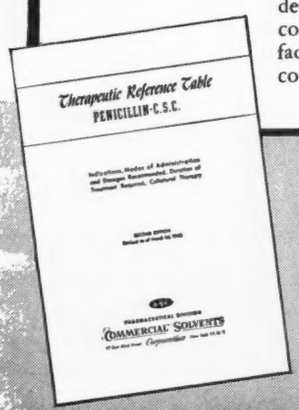
A patient with an abscess of the prostate improved with aspiration of the abscess and administration of staphylococcus antitoxin, but improvement proceeded more rapidly and recovery followed when penicillin was given. Total dosage, 140,000 O.U. intravenously, 955,000 O.U. intramuscularly.

Stainsby, W. J.; Foss, H. L., and Drumheller, J. E.: Clinical Experiences with Penicillin, Pennsylvania M. J. 48:119 (Nov.) 1944.

•

Staphylococcic bacteremia secondary to a toe infection in a 20 year old white female failed to yield to sulfadiazine (690 gr. administered over a 4-day period), but responded to a total dosage of 2,250,000 O.U. of penicillin started intravenously and continued intramuscularly until temperature had been normal for one week.

Kenney, J. F.: Report of a Case of Staphylococcus Bacteremia Treated with Sulphadiazine and Penicillin, Rhode Island M. J. 27:633 (Dec.) 1944.



The Penicillin-C.S.C. Therapeutic Reference Table shows the dosages, modes of administration, and duration of therapy recommended in the conditions in which penicillin is the recognized treatment. A copy of the Second Edition, revised as of March 1st, 1945, has been mailed to every physician. If your copy has not been received, please notify us.

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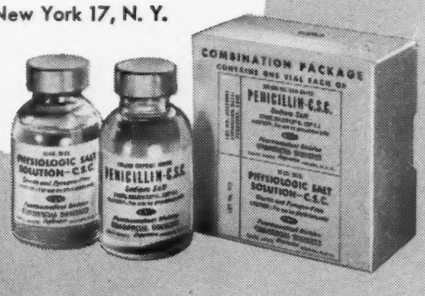

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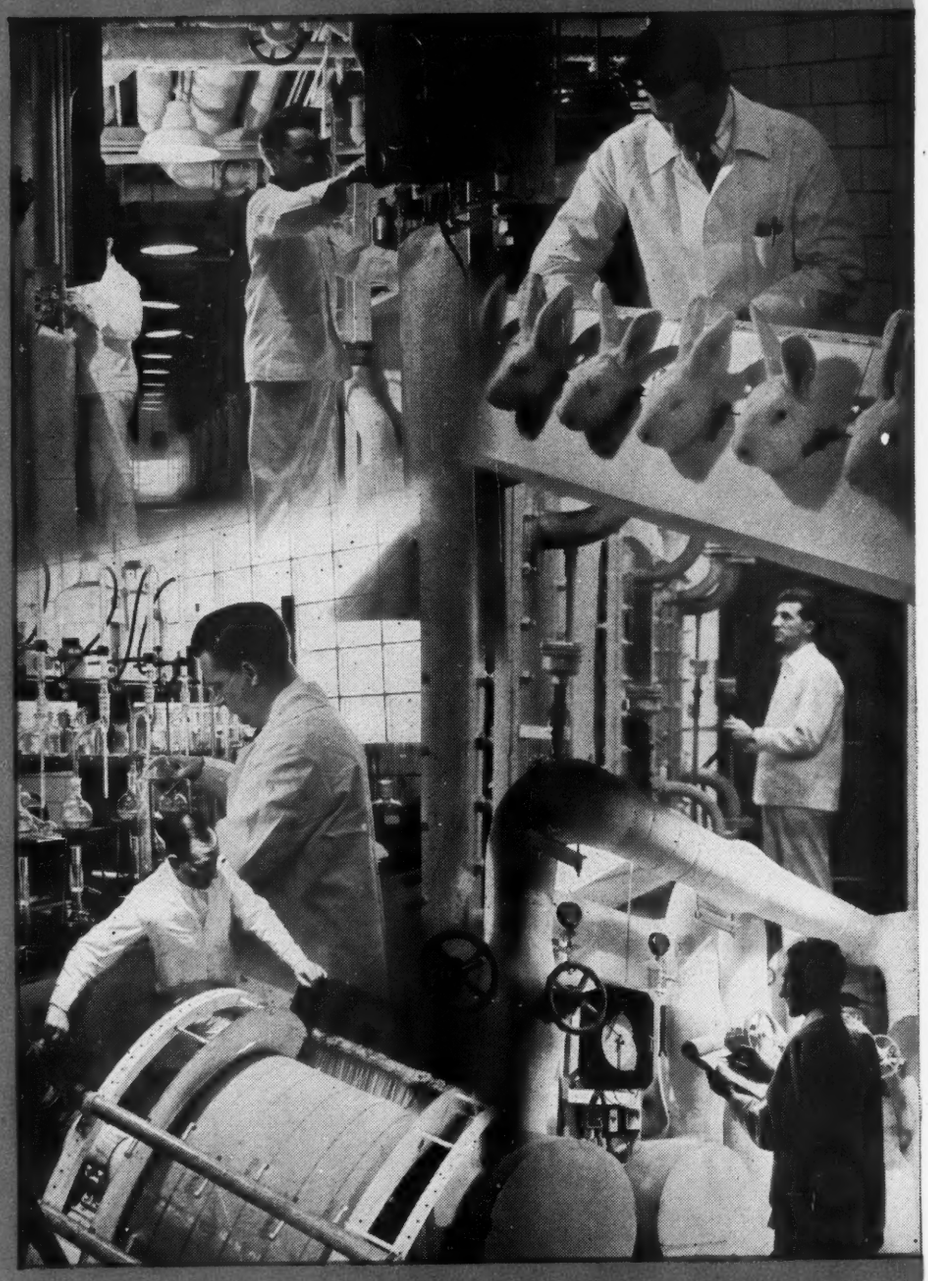

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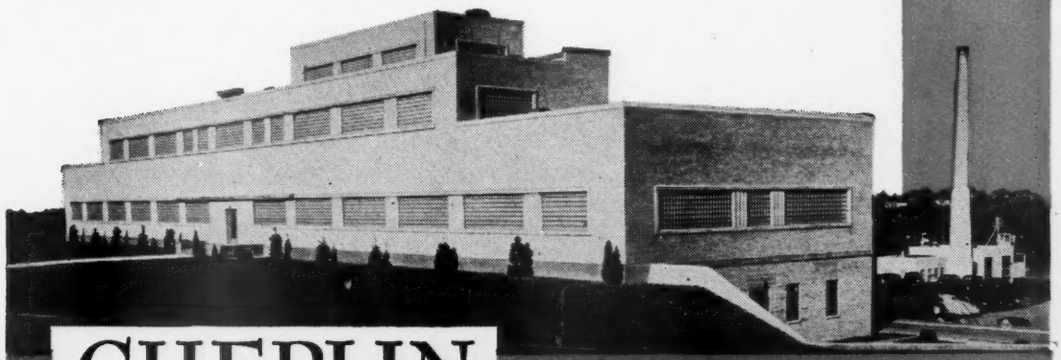

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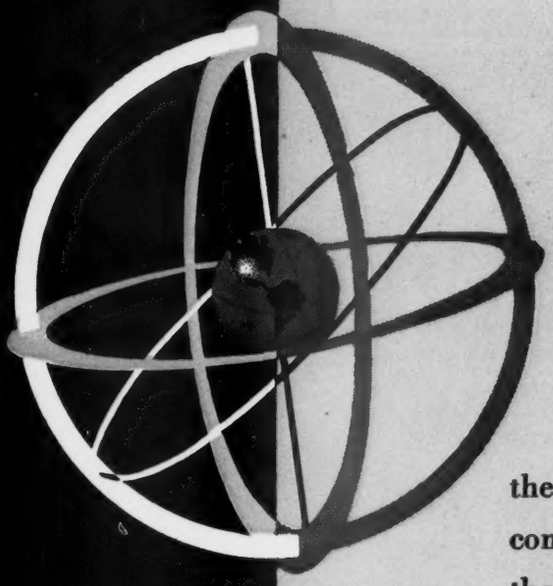

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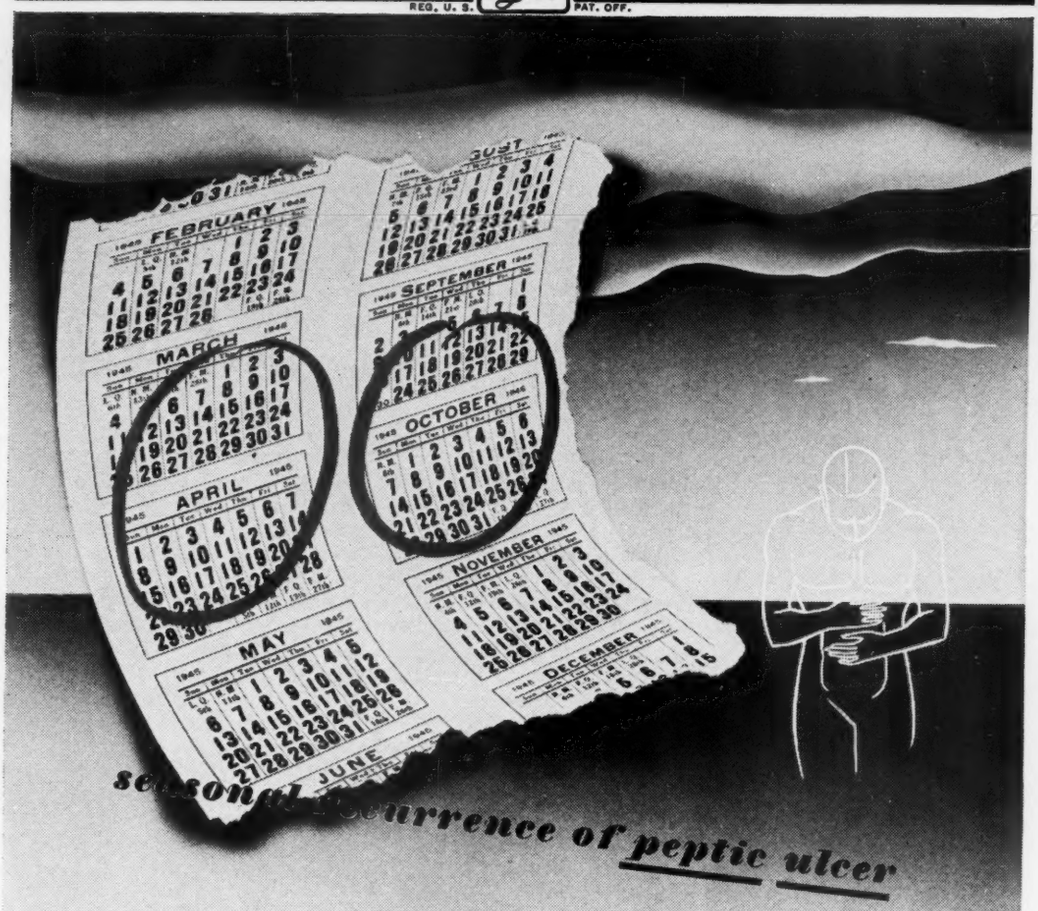

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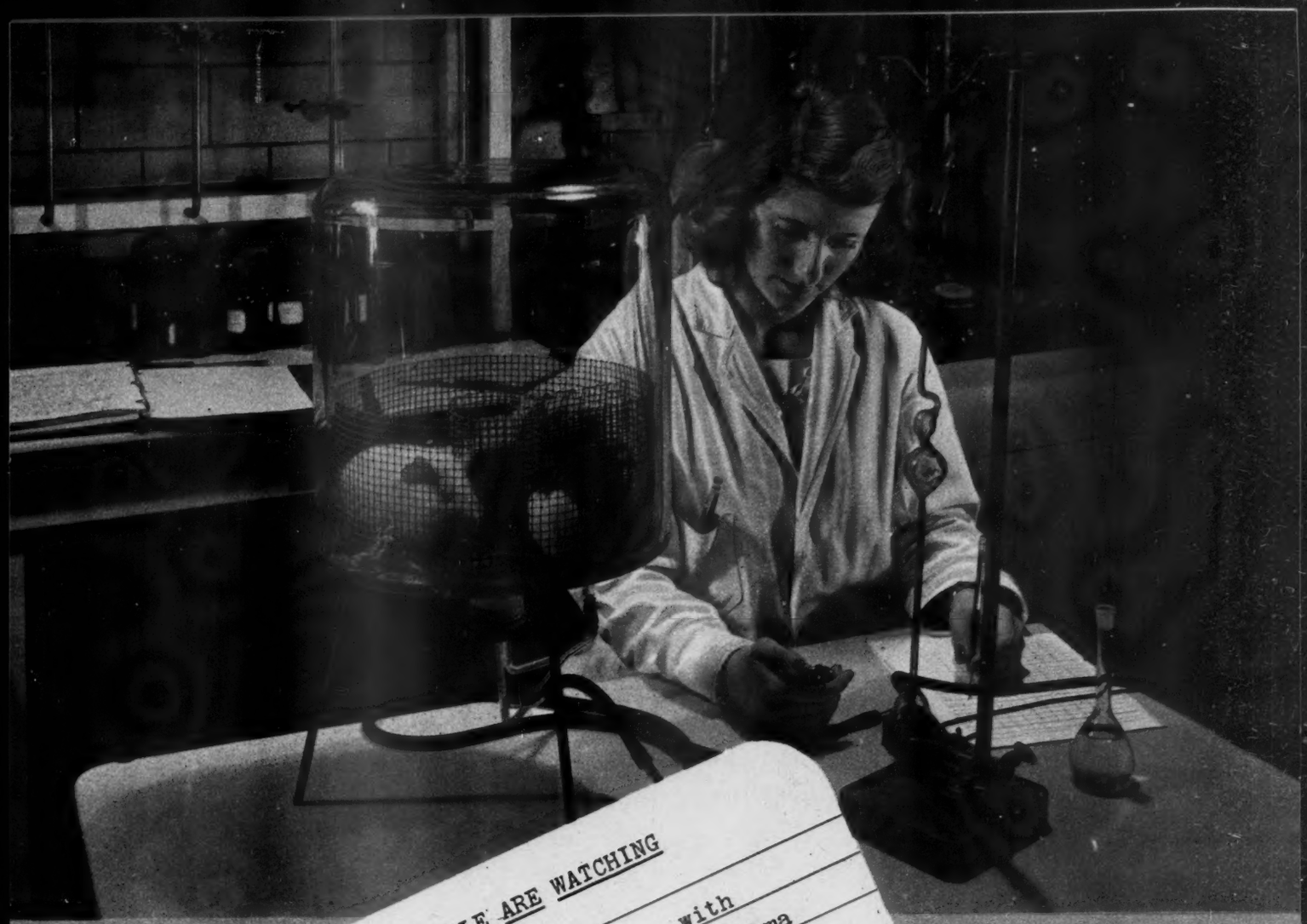

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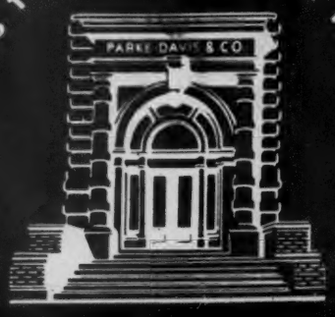

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*Reznikoff, P. & Goebel, W. F.: J. Clin. Investigation, 16:347; 1937

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NEW SERIES VOL. LXIX AUGUST, 1945 NUMBER TWO

Editorial

THE MANAGEMENT OF CARCINOMA OF THE UTERINE CERVIX

IT has been stated that approximately one-third of all carcinomas in women occur in the uterus and that 90 per cent of them are found in the uterine cervix. Thus, this lesion assumes important proportions. According to the Cancer Committee of the League of Nations, carcinomas of the cervix are divided clinically into four distinct groups. In group I, the growth is limited entirely to the cervix, the uterus is freely movable, and no paracervical infiltration can be detected. In group II the parametrium is involved; the infiltration can be palpated under the vaginal wall or beside the cervix; the palpable infiltration may extend outward nearly to the pelvic wall, but the uterus still retains mobility. In group III the parametrium is involved to the pelvic wall on one or both sides, with partial or complete fixation of the uterus. In group IV the carcinoma has invaded adjacent viscera or extensively involved the vagina, or has produced distant metastases.

The history of operative gynecology may be said to have been written around the treatment of carcinoma of the cervix. Originally cauterization of the neoplastic cervix by means of the soldering iron or by chemicals was employed; this method was improved by the development of the electric cautery. About all that this could accomplish was the conversion of a foul sloughing ulcer into a clean one; rarely was a cure observed; and this only in the earliest or smallest lesions. Percy and a few followers advised the use of the Percy cautery. This method, which was short-lived, was at its height during the second decade of this century. Certain cures have been observed with high amputation of the cervix at the level of the isthmus, when the lesion was at its earliest stages and when the incision had been made in sound tissue some distance above the involved area; but the advocacy of a restricted operation when a more extensive one might be performed in the fight against cancer proved to be a false therapeutic conception. Next came vaginal hysterectomy, first with clamps and then with sutures, both methods showing disappointing results.

With the advent of abdominal surgery, simple abdominal panhysterectomy with the ablation of the adnexa came into vogue. First performed by W. A. Freund, in 1878, it was commonly practiced at the end of the nineteenth and at the beginning of the present century. Recurrence was the rule following simple vaginal and abdominal panhysterectomy with the removal of the adnexa, since these operations were not extensive enough to remove all

the involved tissue, and five and ten-year arrests of the disease were exceptional.

In 1895, at the Congress of Frankfurt, Emil Reis, of Chicago, gave the first systematic description of enlarged or radical hysterectomy as practiced today, although at that time he had not performed the operation. This procedure consisted of removal of the uterus with its adnexa, the parametria, a vaginal cuff of sufficient length, and the involved regional nodes. The first operation following these principles is said to have been performed by John J. Clark of the University of Pennsylvania. The name of Wertheim has become attached to the radical abdominal operation because of his painstaking records, his careful follow-up of patients, his searching histological studies, and his extensive publications. The Wertheim operation consists of the ablation of the uterus, the tubes and ovaries, the parametria, the iliac and obturator glands when removable, and almost all of the vagina. Wertheim advised the use of right-angle clamps on the vagina in order to shut off the cervical neoplasm from the surrounding structures while removing the pelvic organs. The Latzko operation is somewhat more extensive than the Wertheim, since there is greater separation of the connective tissue under the uterine artery and lateral to the ureter. There is also a wider removal of the parametrium, the paravaginal tissue, and the tissues below the bladder floor.

A number of pelvic surgeons, led by Jonnesco, extended the dissection to the search and removal of the sacral and lumbar glands. This was soon abandoned by most operators, however, as it was believed that when these glands were involved the carcinoma was beyond surgical control.

The Wertheim operation was popular in the second decade of this century. This operation, radical and formidable though it was, greatly improved the results, and was responsible for a constantly increasing number of five and then ten-year arrests of the disease. While Wertheim and others were developing the abdominal operation, Schauta was elaborating radical vaginal hysterectomy, a method that also gave durable results but that could not enter into real competition with the abdominal procedure; because when operation was done vaginally, the pelvic lymph nodes could not be dissected and removed. Subsequently, Adler added radium capsules to the sides of the pelvis after performing an extended vaginal hysterectomy.

During the time the Wertheim operation was extensively practiced the mortality was high, since in those days preoperative and postoperative treatment were not so well developed as they are today, since blood transfusion had not been well elaborated, and since the sulfa drugs and penicillin were unknown. Nevertheless, it was the only means of combatting a disease that was universally fatal if allowed to run its course unchecked.

Radium was discovered by the Curies and G. Bémont, of Paris, in 1898, but did not receive serious consideration in the management of carcinoma of the cervix until the end of the second decade of this century. It was originally employed only when the operation could not be performed—in the so-called inoperable cases. Group I and a number of group II cases were selected for surgery, while some group II cases, all group III cases and some group IV cases were selected for radium therapy. The striking results obtained by radium in the healing of the primary lesion in a large number of unfavorable cases were responsible for the extension of its use to group II and group I cases, until eventually, in America at least, the radical operation was almost totally abandoned. Simultaneously, with the use of radium, high-voltage *x*-ray was developed, perfected and used in conjunction with radium therapy. As time went on it was discovered that women who had been cured of carcinoma of the cervix by means of irradiation with radium and *x*-ray died of metastases. This led to the belief that neither radium nor *x*-ray cured patients when the regional glands were already involved in carcinoma.

Victor Bonney wrote: "I have on many occasions, at the close of the operation, discovered an infiltrated gland or mass of infiltrated cellular tissue so adherent to the great vessels as to be irremovable. All these patients were treated by *x*-ray, but in spite of a definite target to aim at, not one was saved."[1]

The inability of irradiation by means of radium and high voltage *x*-ray to destroy regional carcinomatous glands led Taussig, in the decade 1930 to 1940, to develop and recommend his method of pelvic lymphadenectomy combined with radiation therapy. In 1943, he reported 175 such operations performed by him and his associates, with a primary mortality of 1.5 per cent and a relatively high survival rate in group II cases of carcinoma of the cervix. A number of gynecologists may have recognized the value of Taussig's contribution, but few followed in his footsteps. Practically all those who had been trained in the technic of the radical abdominal operation believed that pelvic lymphadenectomy did not solve the problem, but that if surgery were attempted, the uterus and adnexa, the parametria, and most of the vagina should be removed in addition to the regional lymph glands. Some operators have continued to use the radical abdominal operation in selected cases, and a few others have taken it up more recently. As it is practiced today in this country it is limited largely to group I cases—those that are considered good surgical risks. Under this régime the primary mortality has been reduced nearly to that of simple abdominal panhysterectomy. Credit for these results should be given to better preoperative and postoperative care, to the transfusion of blood plasma and whole blood, to the sulfa drugs and penicillin, and to the judicious use of radium to heal a sloughing cervix previous to operation, thus minimizing the danger of severe infection in the form of peritonitis or septicemia. Group I cases considered poor surgical risks, group II and group III cases, and some group IV cases are treated by irradiation with radium and *x*-ray. The histologic classification of Broders and Martzloff have been valuable in grading squamous cell carcinoma of the cervix and have been helpful in determining the prognosis of those treated by irradiation. They point out those cancers made up of cells that are sensitive or nonsensitive to the radiating elements.

On the whole, it has been recognized that adenocarcinomas and adenoacanthomas of the cervix respond better to surgery, when it can be applied, than they do to radium and *x*-ray. The main contraindications to radical abdominal hysterectomy, no matter at what stage of the disease, are gross obesity and severe co-existent disease.

In the light of our present knowledge, the best results in the treatment of carcinoma of the cervix will be attained by an intelligent combination of surgery and irradiation. Furthermore, experience has taught the most successful results are obtained when the original treatment, be it surgery or irradiation, is adequately applied, since incomplete surgery or insufficient irradiation inevitably leads to recurrences, treatment for which is almost always unsatisfactory.

The pelvic surgeon who has had the opportunity of perfecting himself in the technic of the radical abdominal operation has also benefited by having acquired a better knowledge of the anatomy of the pelvis. Thus, he has obtained confidence, and the ability to perform other types of pelvic operations which he could not have obtained by other means.

Louis E. Phaneuf, M.D.

[1] *J. Obst. & Gynaec.*, 48: 421, #4.

Original Articles

PLASTIC SURGERY OF NASAL FRACTURES*

EDWARD S. LAMONT, M.D.

HOLLYWOOD, CALIFORNIA

FRACTURES of the nose are frequently overlooked. The initial swelling, coupled with frequent epistaxis and ecchymosis mask the normal nasal contour, so that gross deformity may not be apparent. Lateral *x*-rays are often helpful but these too may be misleading. Thorough examination may be painful and the patient is all too ready to persuade the surgeon that there is no fracture.

Many papers have been written on the signs, symptoms and treatment of early fractures.[2,5,12,15,16] Stress has been laid, not only on restoration of the bony vault, but also the cartilaginous structure and the septum. Few rhinologists have ever seen a thoroughly straight septum in the adult which would lead one to believe that incidental nasal trauma suffered in childhood results in malformation of growth. Too often a patient with a perceptibly crooked septum can recall no history of fracture.

Unreduced nasal fractures are not only cosmetically unattractive but interfere with the physiology. Should the fracture occur early in life, growth of the structures may be impaired, and this must be kept in mind when reconstructive procedures are contemplated. (Fig. 7.) A severely traumatized nose should be considered fractured until proved otherwise. When reducing an early fracture, the surgeon should attempt only to return the structures to their previous position.

In this paper we shall deal primarily with the deformities resulting from unreduced nasal fractures, and report further on the experimental and clinical course of necrocartilage.

EVALUATION OF THE DEFORMITY

Pre-surgical Study. The surgical technic is elastic and will depend on the type of deformity presented. In each case a plaster cast is taken of the face. One side of the nose is measured and marked to indicate the desired size, shape and contour of the nose that will both correct the deformity and fit the patient's face. If there is a depressed fracture or marked saddle, modelling clay is used to build up the deformity. Photographs are taken: profiles, profiles smiling, front view, the triangle of the nose with the head tilted backward.

Nasal Septum. The presence of a deviated septum is not always an indication for a submucous resection. The latter should be performed only when it is causing a mechanical obstruction, or interfering with the normal physiology of the nose and accessory sinuses. Often a slight deviation in the presence of a vasomotor rhinitis or allergic condition will appear to be causing mechanical blockage. Surgery on the septum will not alleviate this condition; the turbinates will merely bulge further to meet the wall. The surgeon, therefore, should judge each case carefully before performing a submucous resection.

When this operation is indicated in cases of old nasal fracture, it should be done thoroughly. Merely removing a section of

* Presented in conjunction with colored surgical motion pictures as part of a series of Faculty Lectures to the War-Time Graduate Medical Meetings (Army and Navy General Hospitals) Zone 24, under the auspices of the American Medical Association, the American College of Physicians and the American College of Surgeons.

the cartilaginous septum, a guilty spur or a small portion of the supposedly obstructing septum, will usually prove partner in causing the nose to be crooked. (Figs. 3, 4 and 6.)

We have attempted many methods in

A B

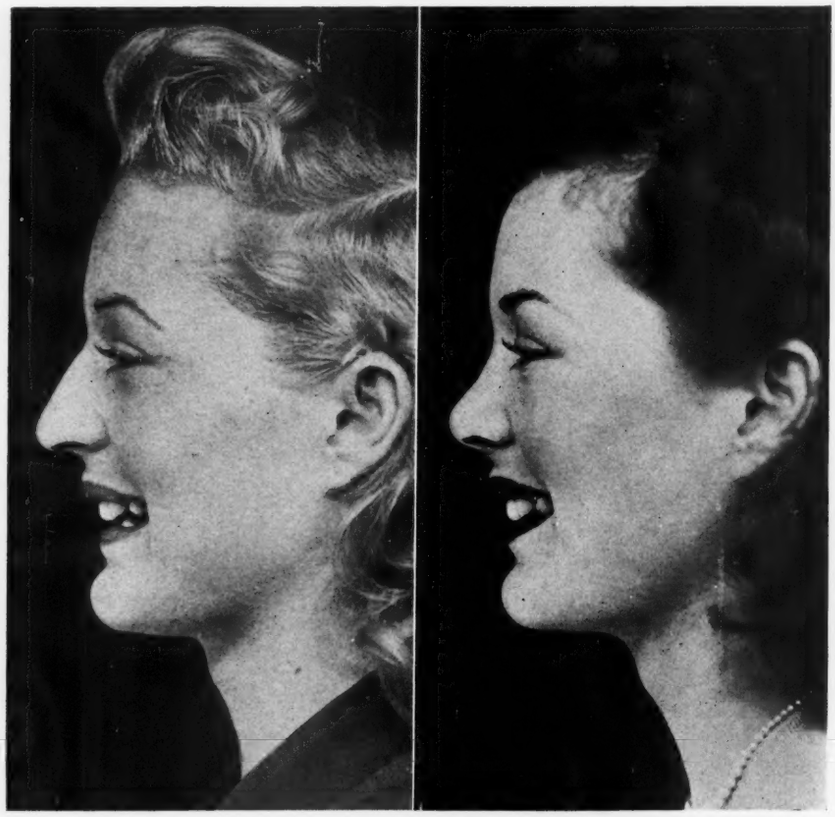
FIG. 1. Fracture of the nose with a depressed bridge, dropped tip, flattened nostrils and disappearing columella. Complete reconstruction was required with insertion of a cartilage graft over the dorsum and within the columella.

quite disappointing both to the patient and the surgeon. Unless sufficient ethmoid plate, vomer, bony maxillary ridge and cartilage are taken, the mucous membrane which becomes thickened after surgery merely bows over to its old position. The surgeon should consider that once a submucous resection is done, the septum cannot be reoperated without danger of a perforation. When necessary, it has been found advisable to carry out the submucous resection four to five months following the nasal reconstruction.

Displacement of the septal cartilage in the unreduced fractured nose is almost the rule. The displacement not only interferes with the nasal physiology but is cosmetically unattractive as it protrudes from one nostril in many cases and often is a

relocating the septum and holding it in position.[4,9,13,14] In some cases we have pierced it with a wire and run the latter to an opposite incisor; run a wire protected by a lead plate to the opposite ala; made a circular incision along the septum to allow it to bend. We now use the following method and find it quite satisfactory: Prior to removing the required amount of septum from its inferior and anterior aspects, an Asch forceps is introduced, one blade passing between the septum and disengaged columella, the other parallel along the nasal floor. The cartilaginous septum including the vomer is tightly grasped and forcibly bent in the direction opposite to that of the deformity. After thorough loosening the septum is rocked several times. The blades of the Asch forceps are

then passed upward, now grasping the cartilaginous septum and the ethmoid plate; a similar procedure is repeated as below. Meticulous care is taken to sew the columella to the septum with interrupted silk sutures. The results have been quite satisfactory and we have had no untoward reactions.



A B

Fig. 2. Old nasal fracture with a twisted dorsum and a markedly deviated septum. A total osteoplastic reconstruction was performed.

Bridge. The majority of fractures result in injury associated with a dislocation of the nasal bones. Less rarely is the nasal process of the maxillary bone injured. With a shifting of the osseous structures, the upper lateral cartilages often suffer fracture or dislocation. (Figs. 2 and 10.)

The upper lateral cartilages are a direct continuity of the cartilaginous septum. Their posterior superior borders are in fibrous contact with the nasal bones and the ascending frontal process of the maxilla. The inferior border has a fibrous attachment to the lower lateral cartilages. It is obvious that should a fracture dislocation occur during the growth and developmental period, an interference with the bony and cartilaginous bridge will affect the contour of the whole nose.

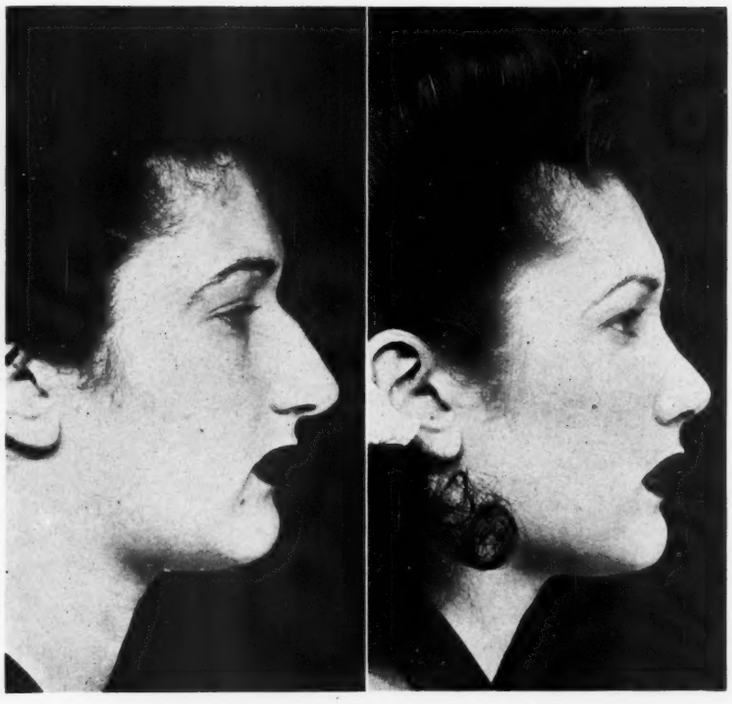
Correction of the bony deformity is carried out by removing the anterior excess with bayonet bone saws, then performing a lateral osteotomy through the nasal process of the maxillary bones and deflecting the distal fragments medially. (Fig. 5.) A chisel is introduced in the center of the osseous bridge between the nasal bones and the ethmoid plate to gain greater freedom for the immobilized maxillary fragments.

The upper lateral cartilages are severed from the septum in the midline and a hyperbolic wedge is taken on either side, which not only narrows the nose to the required measurements but also allows more breathing space.

Tip. The contour and position of the nasal tip is determined by the lower lateral cartilages and the septum. Injury to nasal structures may cause the tip to be dropped, flattened, bent or asymmetrical. If the injury is of long standing, the lower lateral cartilages may be buckled and the tissues hypertrophied. (Figs. 1 and 9.)

Often the septum on the very tip may be bent causing the whole lower half of the nose to be deviated to the affected side. We have found the following procedure

FIG. 3. Patient suffered a broken nose ten years ago. The septum was dislocated to the right and the lower lateral cartilage on the same side was more prominent. A and C, depicting the associated congenital deformity with a second degree hump, a dropped tip and relatively long anteroposterior dimensions. B and D, after surgery: relocation of the septum into the vomer groove and complete reconstruction of the nose.



A B

FIG. 4. A nasal fracture in childhood caused a septal dislocation with deviation of the septum but no marked blockage of breathing. The septum was relocated with an Asch forceps while carrying out the nasal plastic operation.

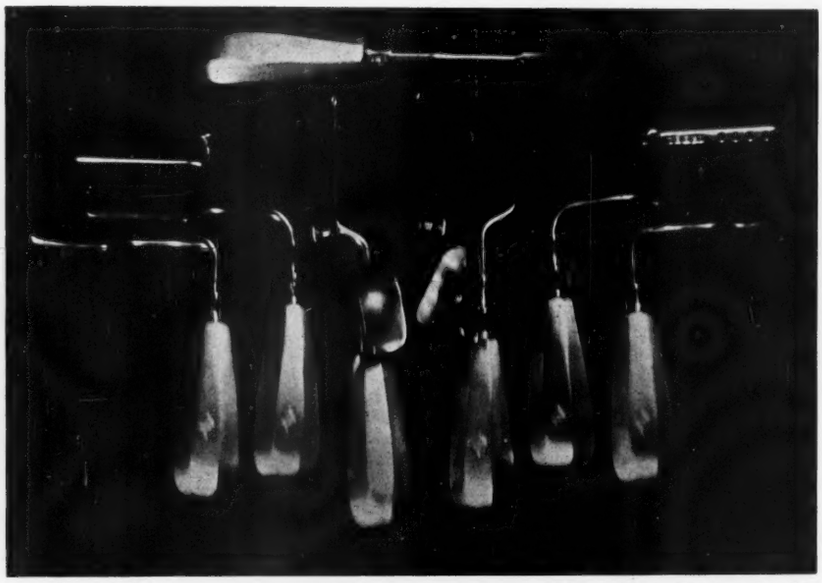


FIG. 5. Author's nasal saws: The handles are rounded and bevelled to fit the operator's palm. Thumb rests on the two dorsal saws assure a firmer grasp. The teeth are in a double row bevelled to a "V." Guards constructed for the cutting edge of the saws prevent injury to the teeth while they are being autoclaved and handled.

to be effective in the correction of such a deformity. The septal mucous membrane on the affected side is undermined and spine; each succeeding incision more forward. The knife is carried through to the opposite mucous membrane lining and a

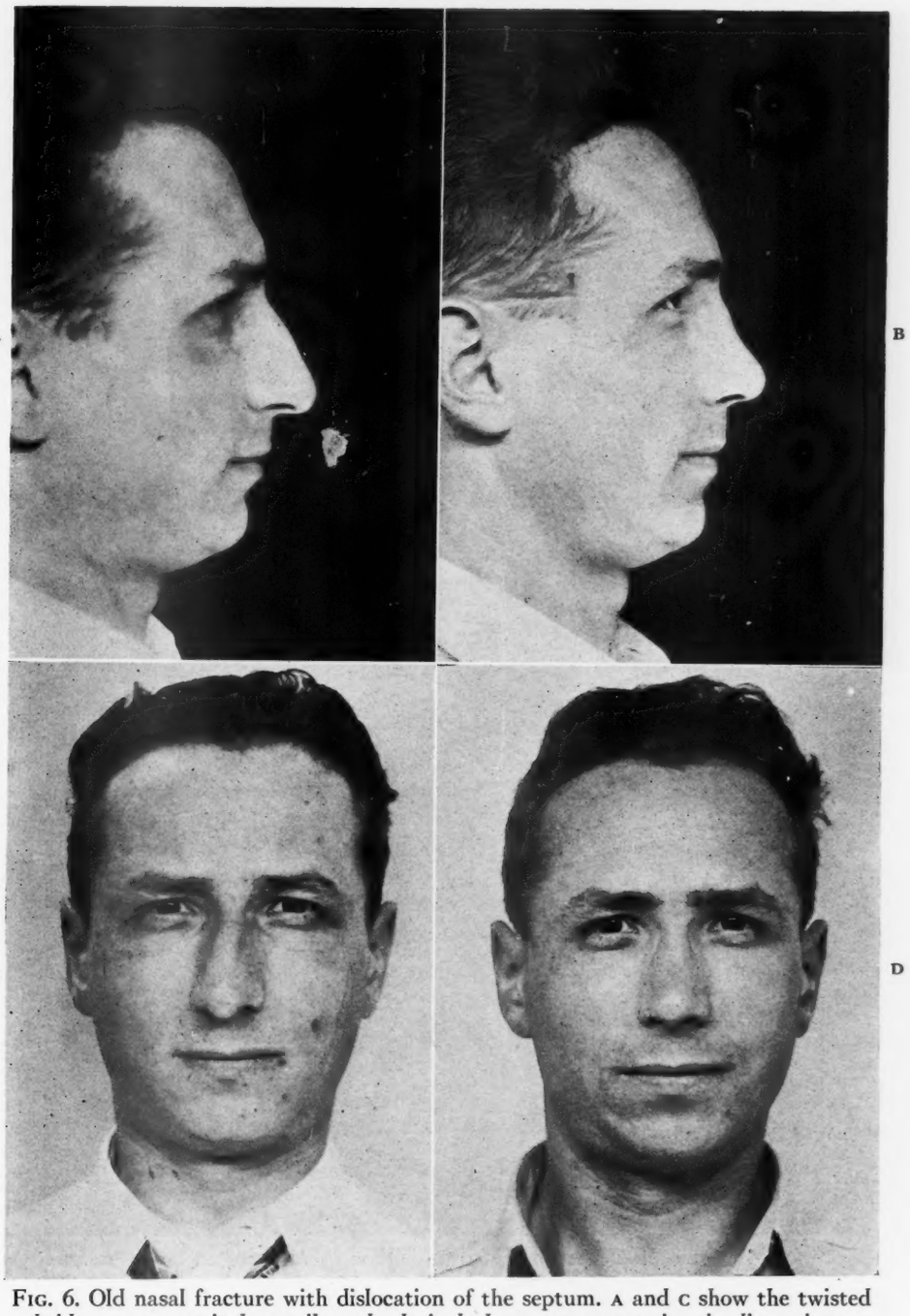


FIG. 6. Old nasal fracture with dislocation of the septum. A and C show the twisted bridge, asymmetrical nostrils and relatively long anteroposterior tip dimensions. B and D, after surgery; the bridge and tip have been reconstructed in conjunction with relocation of the septum.

raised. Two or three circular incisions are made on the septum extending from its mid-anterior aspect down to the nasal sliver of septum removed in each position. The reflected mucous membrane is returned to position and several through-

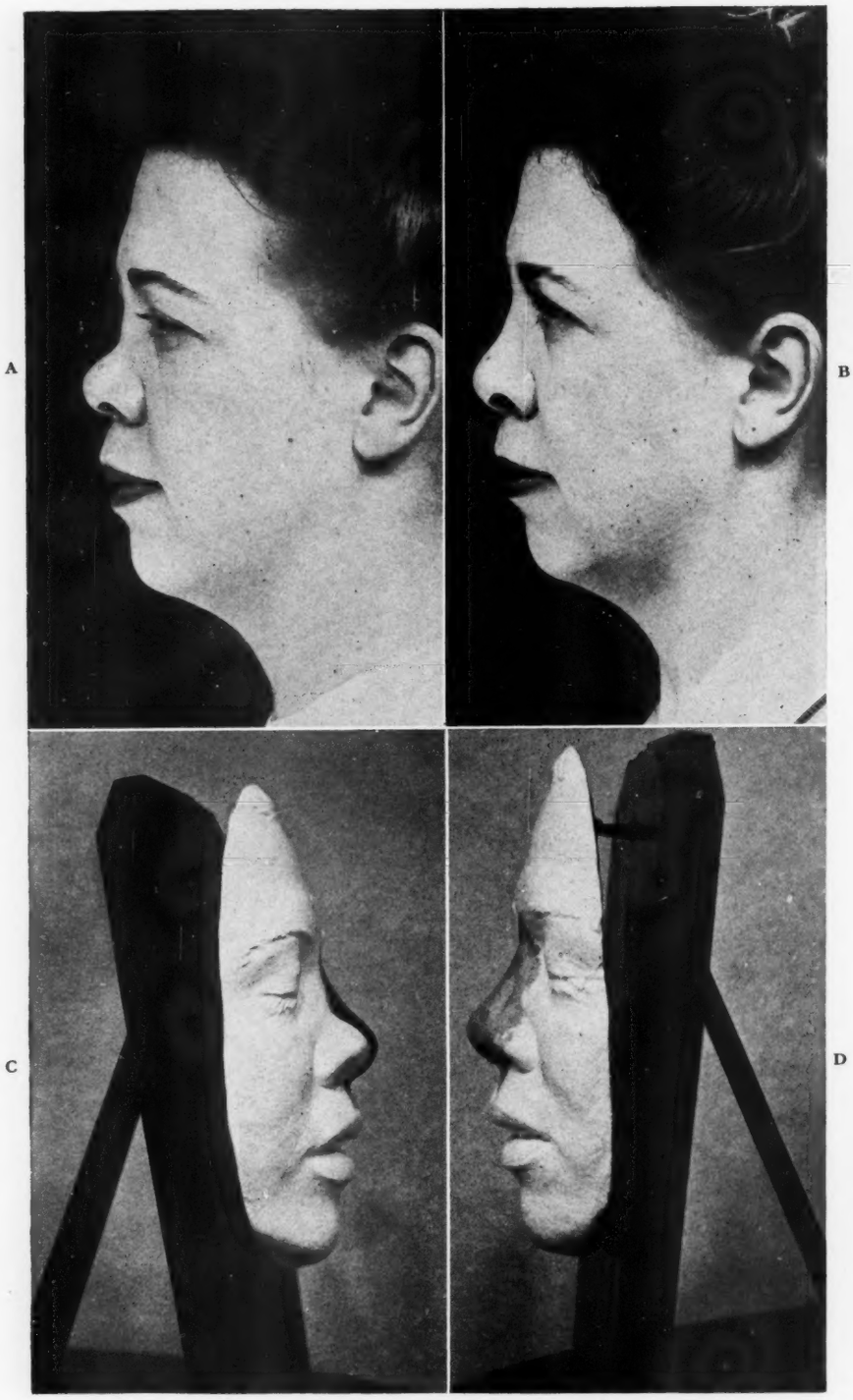
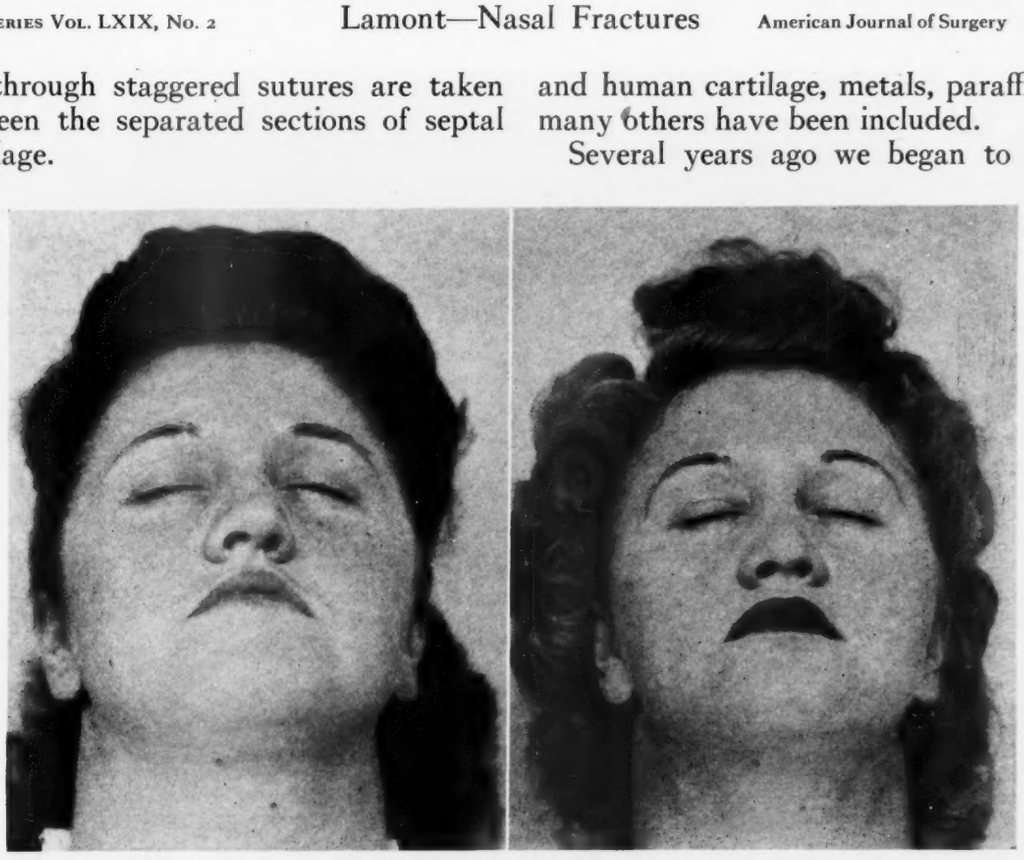


Fig. 7. Fracture of the nose suffered in childhood, resulting in injury to the vomer and causing maldevelopment of the septum. A, B and C demonstrate the saddle bridge with a disappearing columella. The plaster cast modelled with clay depicts the required cartilage graft and plan of reconstruction. D, cartilage was prepared and sculptured to the required measurements. The grafts were then inserted intranasally.

and-through staggered sutures are taken between the separated sections of septal cartilage.



A B

Fig. 8. Old fractured nose in conjunction with a markedly deviated septum. A complete nasal reconstruction was required. Two small rounded plates of cartilage were placed immediately beneath the lower curve of the alae to elevate their position. A thorough submucous resection was performed four months later.

Reconstruction of the lower lateral cartilages should be done meticulously. They are first dissected free without disturbing the nasal lining and thoroughly undermined away from their beds.[8] The requisite amount is then removed allowing the lateral crus to slide medially and form the new tip. We do not hesitate to go below the arch medially when attempting to decrease the antero posterior dimensions of the nasal tip. When necessary a suture is placed between the septum and the columella-philtrum angle.[1] The intranasal incisions are carefully sutured with silk.

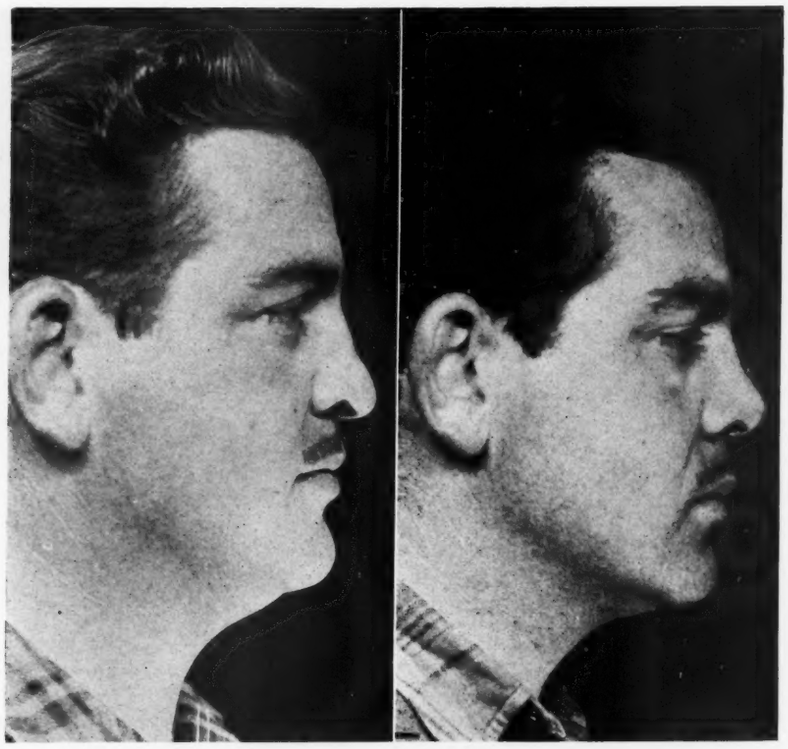
DEFORMITIES REQUIRING THE ADDITION OF CARTILAGE

Various materials have been used to reconstruct absent skeletal and cartilaginous tissue of the nose.[3,10,11] Human and animal bone, ivory, celluloid, animal and human cartilage, metals, paraffin and many others have been included.

Several years ago we began to follow the course of necrocartilage both experimentally and clinically in the human.[6,7]

Experimental Method. Rib cartilage is taken from patients in exitus and the perichondrium removed. It is fixed in formaldehyde solution (4 per cent formalin) four days, washed, then refrigerated in colorless merthiolate solution 1:1,000. When cartilage was required to repair a defect, a section was taken from the same piece and placed beneath the skin of the anterior abdominal wall. In chronological periods of time, i.e., a week, a month, six months, a year, two years and three years, the cartilage was removed from the anterior abdominal wall and examined microscopically.

Pieces of the same cartilage were retained in the merthiolate solution, refrigerated and examined at the identical times for comparison. Sections of autogenous rib cartilage were similarly followed for comparison.



A B

FIG. 9. Injury to the nose resulting in flattened upper lateral cartilages, dropped tip, deformed nostrils and disappearing columella. Total reconstruction with a cartilage graft to the columella.

A B

FIG. 10. Old fracture of the nose in conjunction with a congenital deformity. Complete nasal reconstruction required with relocation of the septum into the vomer groove. The bridge was lowered and the tip reconstructed to the required size.

Evaluation of Results. Cartilage removed from the pocket in the anterior abdominal wall and examined after one week, demonstrated the central cells to be blue stained, with prominent nuclei. In some places the cells were vacuolated. The periphery stained pink with moderate dissolution of the cartilage cells.

After forty-four days, microscopic examination of a similar piece of cartilage removed from the anterior abdominal wall revealed a somewhat identical picture with little other change in the cartilage. One piece of necrocartilage removed from the anterior abdominal wall after three years presented a solid piece of cartilage that grossly resembled freshly prepared necrocartilage. When cut, its consistency was similar and there were no areas of disintegration. Microscopically, the cartilage showed some fibrotic invasion of the periphery and the cells stained pink. Centrally the cartilage cells accepted a bluish stain and appeared similar to the sections examined after forty-four days.

NASAL DEPRESSIONS REPAIRED WITH CARTILAGE

A plaster cast of the patient's face is taken and modelling clay is utilized to reconstruct the nasal defect. Refrigerated necrocartilage is then sculptured to conform to the clay model. Several small holes are bored in the cartilage to allow the entrance of granulation tissue and thus "rivet" the cartilage in place. After the cartilage has been sculptured to the required measurements it is returned to the merthiolate solution and refrigerated until needed for the surgery.

Surgical Method. Often a cartilaginous strut when inserted intranasally will improve the defect but will not gain the best cosmetic and functional result. The presence of a depression of the bridge or a disappearing columella is not an indication to forego the reconstruction of the remainder of the nose. If necessary, we may narrow the bridge, remove the required amount of upper lateral cartilage, reconstruct the tip and carry out such procedures that will effect a more pleasing result.

When cartilage is employed over the bridge, an incision is made between the upper and lower lateral cartilages and a pocket created that will meet the size of the implant. The latter is sprinkled with sulfanilamide crystals, inserted and the incision in the mucous membrane sutured with black silk. The nose is lightly packed with gauze, and careful adhesive tape dressings are applied.

By preparing the cartilage implant several days prior to surgery and allowing it to refrigerate in an antiseptic solution, it is handled a minimum in the surgery and so offsets the threat of infection.

Cartilage thus prepared may be employed as framework for any part of the nose, i.e., a strut in the columella from the tip to the nasal spine, or at the point where the philtrum meets the columella to repair a depression of the latter.

Clinical Results. We have used necrocartilage intranasally in seventy-five cases. Some in this series have been followed over a period of three years. Careful examination reveals no marked clinical change of these cartilaginous implants.

We have lost cartilage in only two cases. Both were at the columellar-philtrum juncture for repair of a depression. In the first, the patient suffered a severe blow on the nose one week after surgery. In the second, we believe the pocket was made too small to house the strut of cartilage and as a result it began to extrude the day following surgery.

In comparison, the clinical course of necrocartilage is similar to that of autogenous cartilage. Its advantages are obvious in that no chest operation is necessary, it may be modelled before surgery, the quantity is not limited, and, too, we believe that allowing it to remain for a time in refrigeration gives it an opportunity to curl *in vitro* rather than *in vivo*.

CONCLUSIONS

1. The unreduced fractured nose must be reconstructed physiologically as well as cosmetically.

2. Necrocartilage has proved a valuable adjunct in repairing nasal depressions.

3. Careful preoperative study is mandatory to gain the required result.

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BILATERAL NUMMIFORM FIBROMYOMAS OF THE NIPPLES WITH UNILATERAL FIBROMYOMA AND PAPILLOMA MAMILLAE*

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TUMORS of the nipples, exclusive of Paget's disease, find infrequent and discontinuous mention in gynecological-surgical discussions. In 1900, Lindfors[15] wrote, "It is peculiar that the knowledge of this form of mammary gland tumor which previous authors like Cooper and Chelious encouraged, suddenly disappeared from treatises on the diseases of the breast in succeeding decades. Billroth could find only the following to say: 'Tumor formations in the nipple and areola are extremely rare; slowly progressive epithelial cancers are supposed to have been observed.' In the last two decades several authors have again resumed the discussions, for instance, Schield, Binaud et Braquehaye. . . . but no one has included a complete casuistik." Rodman[17] and Handley[8] do not include this topic in their text books. Deaver and McFarland,[2] Dietrich and Frangenheim[3] devote separate chapters to the nipple, include much material, especially the former, but neither group completely elucidates the subject. v.Jaschke[21] is again deficient. Cheattle and Cutler[1] have spread relevant material throughout their book without drawing up a separate section. More recently, Geschickter[7] covers the subject with the enumeration of the warty nipple, intracystic papilloma, the pedunculated fibroma, neuroma, and leiomyoma.

Tumors of the nipple are uncommon which probably exonerates the deficiency of textual descriptions. Lindfors[15] collected thirty-seven cases up to 1900: twenty-seven of the mamilla, ten of the areola; thirty in women, seven in men. Dietrich[3] compiled forty cases in 1901: six atheromas, six fibromas or fibroadenomas, three papillomas, five angiomas, three myomas, and fourteen cases of cancer. Deaver and McFarland[2] list a total of sixty-nine instances with nine varieties. MacCarty[16] surveyed 13,168 breasts and portions of breasts removed at the Mayo Clinic between 1907 to 1937 and was able to list thirteen cases of carcinoma of the nipple, two instances of accessory malignant nipple, and one fibroma of the nipple. The thirteen cancers of the nipple were predominately cases of Paget's disease. Our own case which suggested this report is the first encountered at our institution in six and one-half years during which time 333 tumors of the breast were examined (120 benign, 213 malignant).

Despite their infrequency mamillary tumors are no mere curiosity. Their pathology is variegated, their manifestations numerous and interesting. In Table 1 the different tumors of the nipple have been assembled. A report covering our case is justifiable because the tumors are bilateral, they are discoid in form, and one tumor is mixed consisting of fibromatous and papillomatous components. The tumors

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TABLE I
TUMORS OF THE NIPPLE

Epithelial

Benign
1. Papilloma[3,4,15]
2. Intracystic papilloma[2,15]
3. Intracanalicular (vestibular) papilloma[10]
4. Cystadenoma proliferum papillare[15]
5. Cystoma papillare[15]
6. Cysts[2,3,15]
   a. epidermoid
   b. atheromatous
   c. nondescript

Malignant
7. Epithelioma[1,2,3,15]
   a. squamous cell
   b. transitional cell
   c. ulcus rodens
8. Sebaceous gland adenocarcinoma[1]
9. Medullary fungus carcinoma[15]
10. Scirrhous carcinoma[15]
11. Intracanalicular[1,2,15]
    a. duct cell
    b. cylindrical cell
    c. cystocarcinoma papillare
12. Paget's disease

Non-epithelial

Benign
13. Fibroma[2,3,13,15]
14. Fibroadenoma[15]
15. Angioma[3,15]
    angioma cavernosum
16. Leiomyoma[2,3,14,15]
    myoma telangiectoides (Virchow)
    cystic myoma
17. Fibromyoma[3,15]
18. Neuroma (Stewart)[19]
19. Neurofibroma[19]
20. Pigmented nevus[1,3]
    congenital moles

Malignant
21. Sarcoma (Klebs)[2,3]
22. Leiomyosarcoma[3]
23. Osteoid (osteogenic) sarcoma[2]
24. Melanoma[2,3]

Miscellaneous-related

25. Papilla verrucosa (warty nipple)[21]
26. Cornu cutaneum (Bauer)[3]
27. Keratosis areolaris naeviformis (Tissi)[20]
28. Dyskeratosis (Fischel-Jorstad)[5]
29. Acanthosis nigricans (Koch)[12]
30. Lymphoid hyperplasia in nipple (Kengyel)[11]

The "*PEDUNCULATED TUMOR*" of the nipple includes:
a. Fibroma pendulum
b. Fibroma pendulum bulbosum
c. Fibroma pendulum papillomatosum
d. Fibroadenoma pendulum
e. Pedunculated sebaceous cyst
f. Pedunculated papilloma
g. Pedunculated angioma
h. Pedunculated angioma cavernosum

listed in Table I are unilateral, none were complicated by any superimposed heterologous structure, and the most frequent form is the pedunculated tumor. Additionally, our fibroids of the nipples were accompanied by fibroids of the uterus.

CASE REPORT

D. W., was a forty-two year old, single, white, female nurse. Her medical and surgical histories were negative except for measles and pertussis as a child. Her family background was similarly devoid of any medical events. Gynecologically, she reported that the menarche started at sixteen. After an initial stage of dysmenorrhea in the first year, her menses were always normal in duration, intensity, and cycle. With her thirty-fourth year diminution of flow, shortening of the period, and some nervous depression set in. The patient's nipples were always somewhat prominent.

In November, of 1941, while sitting, the patient felt a mass in the left lower abdomen. This tumor gradually increased in size and soon was accompanied by frequency of urination and dysuria but no menstrual disturbances. About the same time of the palpation of her tumor in the abdomen, she noticed sensations of prickling and tingling in the left nipple. Soon thereafter, several prong-like projections appeared. The nipple gradually increased in size for about six months and became painful to touch. In January, 1943, she began to feel the same sensations in the right nipple. This became quite sensitive, especially premenstrual, developed a wart-like tumor that grew quickly and from which a thin, yellow fluid could be expressed. The nipple enlarged rapidly and its size soon overtook that of the left. In retrospect, the patient thought she could attribute the onset of the tumors to traumatism following a tight, pinching support. The breasts proper had remained about the same. At no time were constitutional symptoms noted.

The lady was an asthenically developed, slim individual of good health when admitted. She was still menstruating, felt comparatively well, and was gaining some weight. Pelvic examination determined the abdominal mass to be an enlarged fibroid uterus with lateral expansion and a globular prominence on the left side.

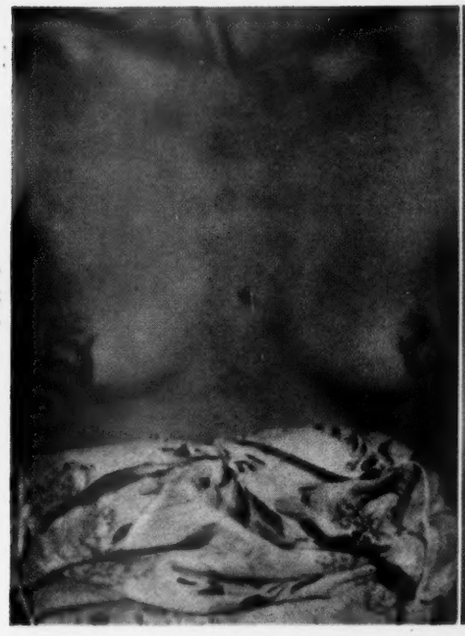

FIG. 1. A, the mammillary tumors at the time of admission.

FIG. 2. A, close-up of the right breast.

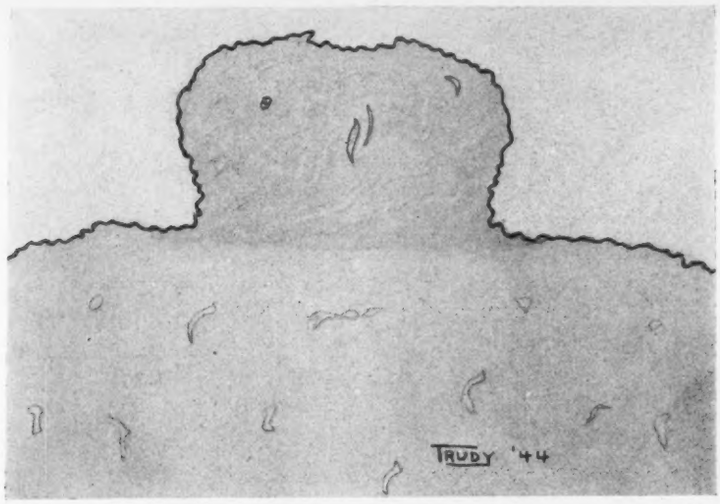

FIG 1. B, section of the left nipple (schematic).

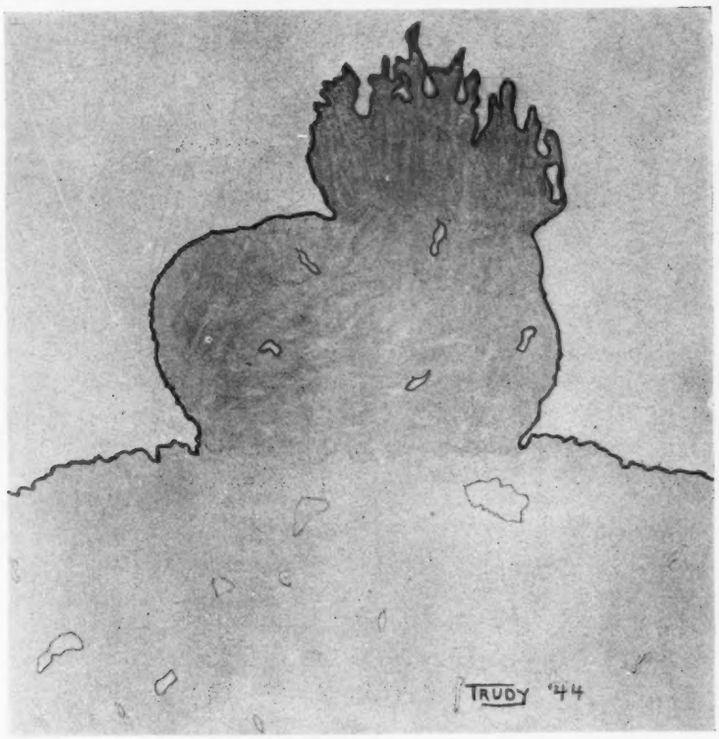

FIG. 2. B, section of the right nipple (schematic).

The breasts were flaccid, of moderate size, their parenchyma dense and hyalinizing. The left nipple (Fig. 1) was replaced by a nummiform tumor 2.5 by 1.8 by 1.5 cm. set off from the breast by a short stalk. On the right side (Fig. 2) the nipple presented a discoid tumefaction, 2.8 by 3 by 2.6 cm., arising from a longer stalk and carrying a superimposed excresence, 1.7 by 1.7 by 1.6 cm. In areas the latter was eroded and covered over with caked serum. The tumors were tender to palpation.

In February, 1944, a hysterectomy was performed through a low, abdominal, midline incision by one of us (J. J. C.). Three weeks later, both breasts were removed by simple mastectomy. An elliptical incision was made transversely about each nipple. Skin and subcutaneous tissues were dissected to the outer margins of the breasts. The latter was freed from the underlying pectoral fascia and removed. The overlying skin was then anchored

FIG. 3. Fibroid uterus removed at the first operation.

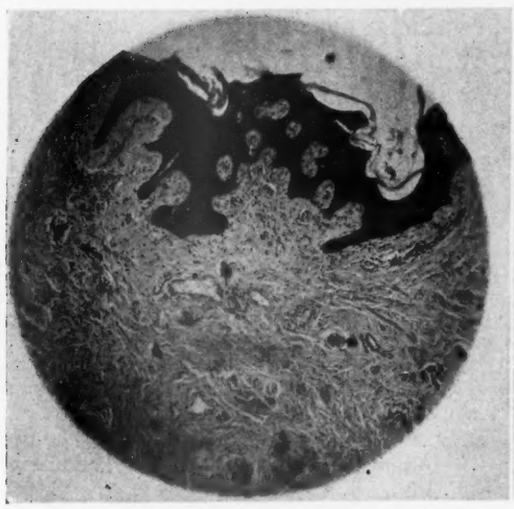

FIG. 4. Microphotograph of the left nipple indicating fibromyomatous character.

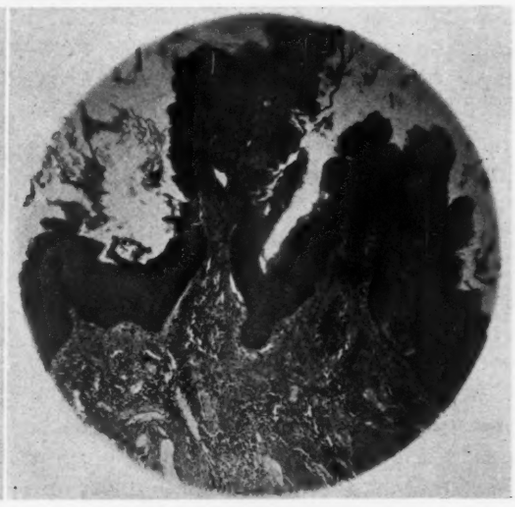

FIG. 5. Section of the papillomatous portion of the right nipple; marked chronic inflammation.

to the pectoral fascia and redundant tissue excised. The wound was closed with silk sutures.

The uterus (Fig. 3) was a specimen of irregular outline and shape, without its cervix. Innumerable large and small fibroids protruded beyond the surface and measured from 1 to 11 cm. The perimetrium was thickened, smooth, and traversed by large veins. Much fibrous connective tissue surrounded the lower uterine segment. On sectioning the specimen, the fibroids were found to be present in all positions, but most of them occupied the left horn; none showed degenerative changes. The uterine cavity was narrow; the endometrium was thin, granular, and hemorrhagic. The right tube and ovary were attached. The former was normal to gross examination. The ovary measured 4.7 by 3 by 1.5 cm.; on section it revealed a cyst 2.7 cm. in diameter, filled with chocolate colored, congealed material and surrounded by a rim of brilliant yellow. Other residual lutein structures were also present.

Microscopically, the following was noted: Irregular endometrium in the late secretory phase but with tubular and cystically distended components; chronic inflammation, edema, and interstitial hemorrhage were also evident. Chronic endocervicitis; multiple large and small fibromyomas; fibrosis of the myometrium; a hemorrhagic corpus luteum cyst, multiple lutein bodies, and fibrosis of the ovary; hyperemia of the tube.

The nipples were described by Dr. V. W. Bergstrom as follows: "Sections from the breasts and the enlarged nipples show the latter to be composed of connective tissue stroma, muscles, and nerves. The stroma is very cellular, the fibrous connective tissue and the smooth muscle components are numerically and qualitatively increased. Dilated ducts are noted, many with papillary and bridge-like structures; these are accompanied by chronic inflammation. Some of the dilated ducts are rather tortuous; others are surrounded by loose, blue staining stroma like that of intralobular connective tissue. The epithelium of some of the ducts is flattened. One nipple has an attached, simple papilloma which manifests marked chronic inflammation.

"The nipple structure is sharply demarcated from the breast proper not by a capsule or a wall but by a definite change in histology. The glandular parenchyma has been replaced by a very dense, almost acellular connective tissue within which are occasional small alveoli. The stroma is collagenous in nature and is in sharp contrast to the proliferative character of the nipple. Between the two an intervening zone containing loose, areolar tissue and fat cells is discernible. Sections stained by Van Giesen's method indicated the fibrous and smooth muscle constituents to be in about equal proportions."

It is proper to designate these nipple structures as tumors for the criteria of neoplasia are fulfilled: proliferative cellularity, hyperplasia, and hypertrophy. These features are exhibited by discrete sections of breasts which otherwise are undergoing retrogressive condensation of their parenchyma. The presence of the papilloma additionally confirms the tumor character of the nipples.

Figure 4 is a microphotograph of a portion of the left nipple to show its fibromyomatous nature; Figure 5 is a section of the papillomatous portion of the right nipple.

SUMMARY

1. The various tumors of the nipple have been compiled.

2. The case of a forty-two year old woman is described presenting bilateral nummiform fibromyomas of the nipples with a papilloma superimposed on the one side.

3. The fibroids of the nipples were accompanied by fibroids of the uterus.

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Acknowledgment to Paula Leonora for the photography (S.E.C.).

In many instances cancer recurs on the site of original operation; this may be several years after the original treatment and is not due to metastasis, but probably is caused by some extensions which were not removed.

From "Metastases Medical and Surgical" by Malford W. Thewlis (Charlotte Medical Press).

THE SURGICAL MANAGEMENT OF SUBSTERNAL AND INTRATHORACIC GOITER*

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MUCH has been written on substernal and intrathoracic goiter in recent years but the terminology has been indefinite. They are not synonymous terms but more recently the literature has been less confusing.

If we are able to adhere strictly to the term "intrathoracic goiter," we must then consider only those within the thoracic cage as true intrathoracic goiters. Those that extend through the thoracic aperture are considered as partial intrathoracic goiters. However, in reviewing the literature one notes that any goiterous tumor that extends into the thoracic cage and remains in that position even after coughing or swallowing or forced expiration is considered an intrathoracic goiter. If one adheres to this classification, the incidence of true intrathoracic goiter will be found to be less than 1 per cent. Partial intrathoracic goiter has a greater incidence, ranging from 25 to 30 per cent in the goiterous areas and 10 to 15 per cent in non-goiterous areas. Crile[1] reported an incidence of less than 1 per cent and Hunt[2] reported three cases of total intrathoracic goiter in a series of 651 cases. Curtis[3] reports the incidence of total intrathoracic goiter as between 1 and 2 per cent. In a series of 4,006 cases at the Mayo Clinic reported by Pemberton,[4] 0.6 per cent were intrathoracic and 13.5 per cent partial intrathoracic goiters.

The ratio of intrathoracic goiter in male and female remains the same, about one to five as any adenomatous goiter. The age incidence averages at about forty-five years. It is rarely found below the age of twenty, but is not infrequent after sixty-five. One of our oldest operative patients was eighty-three years, with a large partial intrathoracic goiter.

Intrathoracic goiters are, as Lahey[5] states, adenomas which developed from a small adenoma in the lower pole of either lobe of the thyroid. Lahey, in more than 14,000 thyroidectomies, has never seen an intrathorax primary hyperthyroid with true hyperplasia.

ANATOMICAL CONSIDERATIONS

The descent of the enlarging adenoma into the thorax is aided by the upward and downward motion of the thyroid in the act of swallowing. Its downward growth, below the sternum, is a natural course since it is the site of least resistance. On its anterior surface it encounters great resistance from the "ribbon" muscles, namely, the sternohyoid, sternothyroid and omohyoid; and also from the sternocleidomastoid. Its descent downward is only resisted by the deeper fascial planes, but these are carried downward through the thoracic aperture and into the superior mediastinum. However, the thoracic aperture is narrow and in order for the adenomas to become larger it must descend deeper into the thorax. In doing so it increases its transverse diameter, a point which is of great importance when it is removed. The depth it may attain is, of course, variable but several cases are reported in which it has almost reached the level of the arch of the aorta. What happens to the trachea is dependent upon the size of the gland. The illustration (Fig. 1) shows the distortion and lateral compression of the trachea. Here one can see how the trachea is distorted and how the lumen is constricted. This accounts for the

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most prominent symptoms of substernal and intrathoracic goiter, namely, dyspnea and choking sensation. It also brings out venous return of the superior vena cava. The other symptoms of thyroid disease,[7] such as nervousness, tachycardia and

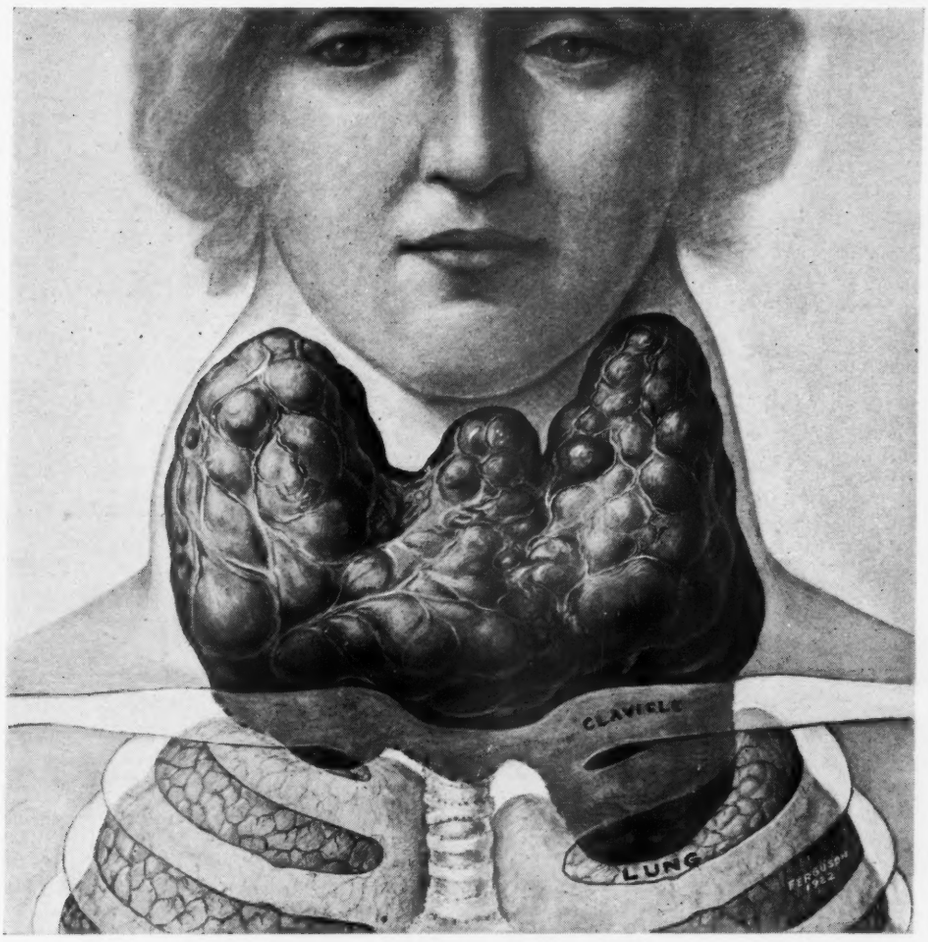

FIG. 1. Partially sub-sternal goiter.

one point in the diagnosis that has been stressed by Lahey, which is the shifting of the thyroid cartilage away from the midline. The result of pressure exerted by the mass on the trachea produces the most serious and alarming symptom. Also, it causes the choice of anesthesia to be a problem which must be carefully considered.

SYMPTOMS

Symptoms of intrathoracic thyroid are dyspnea due to distortion and compression of the trachea; dysphagia due to direct pressure of the goiter upon the esophagus; edema of the neck and head is sometimes present in large intrathoracic goiters due to the pressure of the gland upon the tremor are present to a varying degree, depending upon the amount of toxicity present and, although Lahey has stated that few, if any, of these goiters are truly primary hyperthyroid goiters, a certain amount of hyperthyroidism is present in a surprisingly high number of cases. This, we believe, is evidenced by the high basal metabolism rate, tachycardia and tremor. It is true that all of the complete intrathoracic goiters do not present toxic symptoms but certainly a great number of the partial or incomplete intrathoracic goiters show signs of hyperthyroidism. Although the dysphagia and dyspnea may be present for a number of years they do not become severe until the last few months of the

disease when the symptoms become so alarming that the patient seeks the aid of the surgeon.

mucus collecting in the trachea, the patient is then free to cough and remove the mucus. It will also serve as a guide in

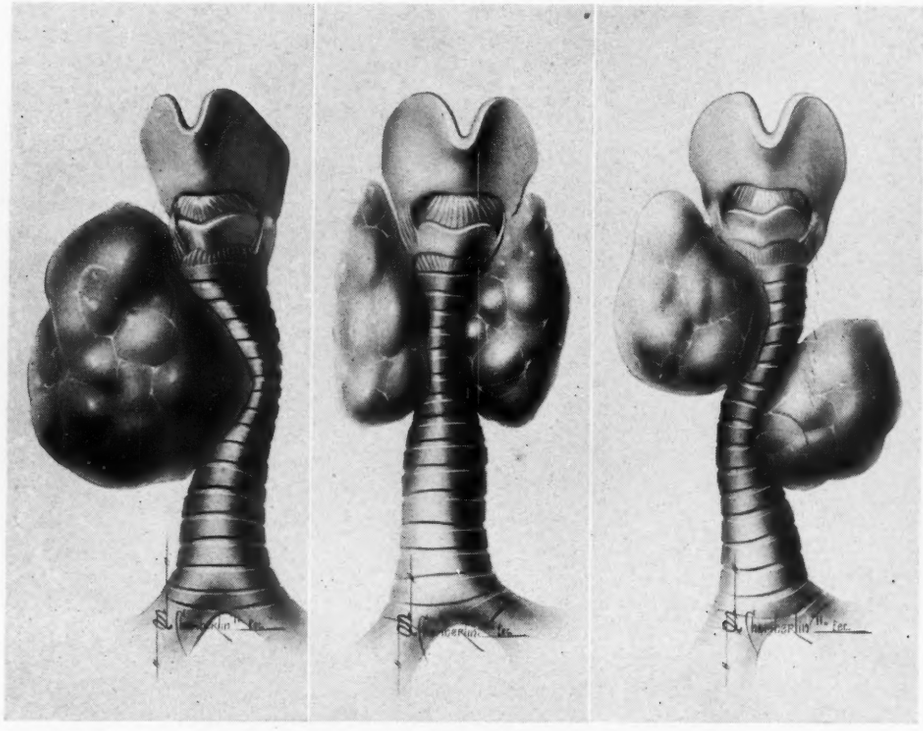

Fig. 2. Tracheal compression due to tumor masses at various levels.

ANESTHESIA

The type of anesthesia most commonly employed in this clinic is local infiltration anesthesia. This has been satisfactory in practically all of our cases. However, when the symptoms due to distortion of the trachea are present one must seriously consider the use of an intratracheal catheter of the hard rubber type with ether as one of the inhalation anesthetics. This will allow more manipulation of the tumor mass as it is being removed without further compression of the trachea and the fear of mucus secretion can be handled quite easily. Many clinics use cervical block anesthesia with excellent results,[9] while some still use nitrous oxide and oxygen.[10] Ethylene cyclopropane is also an excellent anesthesia, but the advantages of local infiltration or cervical block far outweigh the general type of anesthesia in that one has full control of the patient during the operation. Should any difficulty arise with determining the status of the recurrent laryngeal nerve. When using nitrous oxide and oxygen on a patient who has considerable narrowing of the trachea, difficulty is encountered if the constriction does not permit enough oxygen to be carried through into the lungs. Lahey has advised, in these cases, the use of an oxygen-helium mixture. The helium is a good vehicle and the mixture is of much lower molecular weight and can be transported through the constricted trachea much easier.

TECHNIC

The technic used in the removal of such tumors is about the same as that advised by other men, such as Lahey, Crile and Hunt. A low collar incision is made and adequate exposure is essential. The ribbon muscles are transversely severed and retracted away from the field of operation. Crile did not like the idea of cutting the muscles, but most others, as well as we in

this clinic, usually do so and the postoperative cosmetic results are comparable to those in which the muscles have not been severed. One must remember that the blood supply to the thyroid gland comes from the superior and inferior thyroid arteries. The venous return is through the superior, middle and inferior thyroid veins. Therefore, if ligation is first made on the superior thyroid artery and vein, relatively little bleeding will be encountered until the dissection is carried on to the level of the middle thyroid vein. If much capillary oozing is anticipated preoperatively oxalic acid is used as an adjunct to hemostasis.[12]

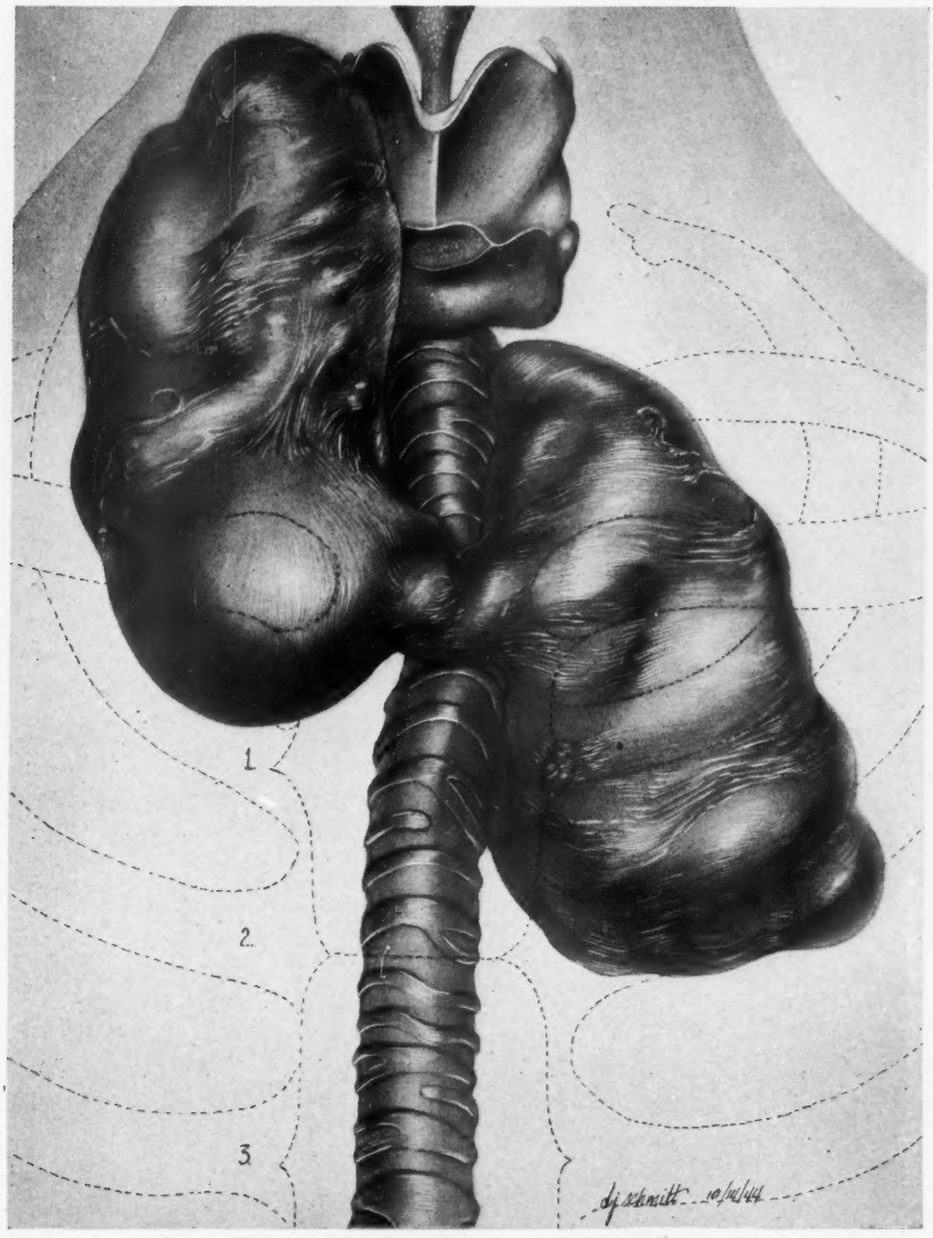

Fig. 3. Sub-sternal goiter (G. B., age eighty, July, 1944).

The gland is then brought forward, exposing these veins, which are clamped and ligated, thus permitting greater traction on the gland. The procedure in the removal of the gland should be carried out within its fibrous capsule. This will prevent injury to the recurrent laryngeal nerve, which lies just below the capsule and hugs the trachea. The intrathoracic portion,

which is the most difficult to remove, can be approached by one or two methods. Lahey uses the method he devised some years ago in which he inserts the index finger posterior to the adenoma, passing it within the capsule and the loose intracellular tissue lying adjacent to the cervical and thoracic fascia. The finger is brought down to the base of the gland if possible. As he makes traction with the Lahey clamp from above, he also forces the gland upward through the thoracic aperture with his finger. In doing so the inferior thyroid artery can be handled in one of two ways,

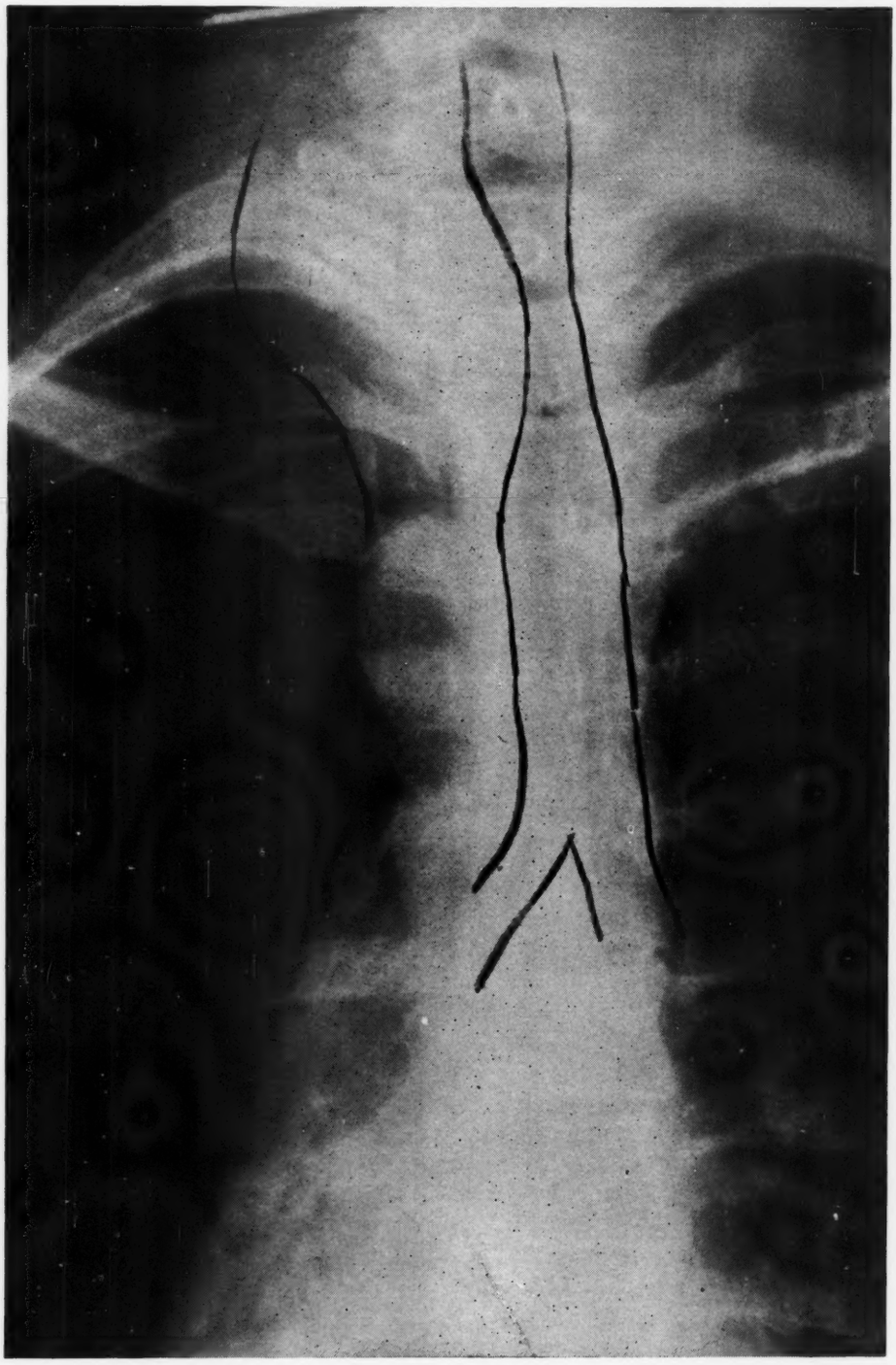

FIG. 4. *X*-ray (retouched) showing compression of trachea.

i.e., ligating it as it is exposed when delivering the tumor, or, at the beginning of the procedure (instead of passing the finger down to the base of the gland), bringing the finger forward and exposing the artery. This latter method is perhaps not the safest method but can be carried out. As the tumor is delivered, there will be a sudden release of negative pressure within the cavity occupied by the gland, causing a re-expansion and shifting of the mediastinum back into its normal position. However, a small cavity will remain in the upper mediastinum and this should be

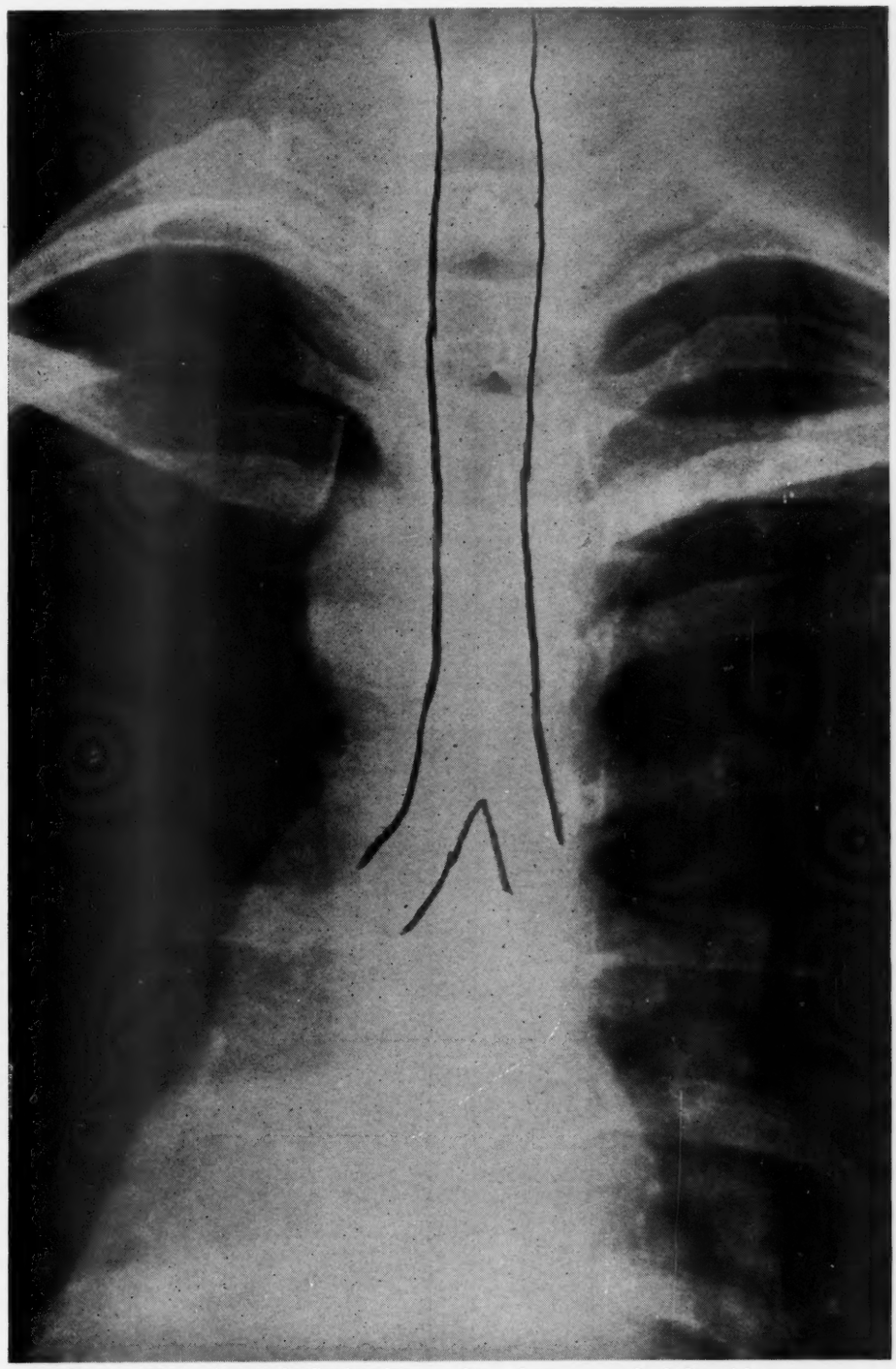

Fig. 5. *X*-ray (retouched) showing trachea after removal of thyroid tumor.

packed with dry gauze, not only to permit hemostasis but also to serve as a drain, thereby keeping the cavity dry. Another method, which is also advised by Lahey, and which is used to great advantage in the true intrathoracic goiter, is passing the finger directly into the gland, breaking up the glandular tissue and removing it, thereby reducing the volume of the tumor and allowing it to be delivered quite easily.

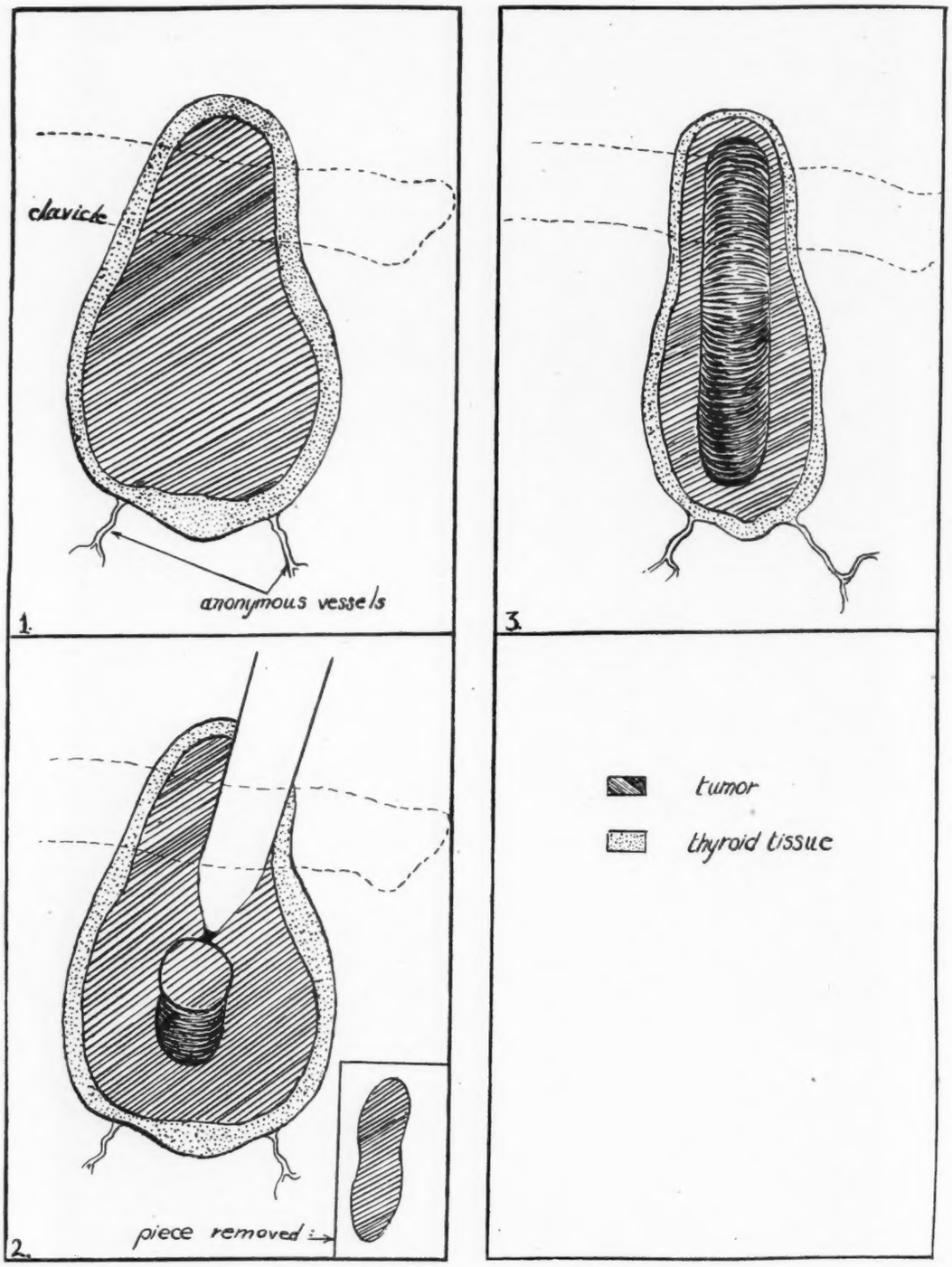

FIG. 6. Morcellation with radio knife.

A method that is sometimes used in this clinic is morcellation of the gland, thereby reducing its size and removing the adenoma in piece-meal fashion. The vessels are

ligated as approached. This method has one advantage of importance. Though the gland is removed in pieces from its thoracic site, bleeding is more easily controlled and the danger of breaking through adhesions containing blood vessels when passing the finger around the gland is greatly minimized. Bleeding here is quite serious and hard to manage as one can imagine, and, therefore, morcellation may avoid this danger. The desire of a surgeon to remove a tumor intact as a specimen is great, but when morcellation makes the removal much easier then it should be done. It is far more desirable to make the procedure life-saving to the patient than to save a good specimen. When one uses one of the latter two methods he must be extremely careful in not allowing any of the glandular tissue to remain within the thoracic cavity, since this is an excellent medium for infection in causing mediastinitis. The drains mentioned previously are not removed in two days but are gradually taken out over a period of five to eight days. In doing so the accumulation of serum which often accompanies following the removal of such tumors will be avoided.

CONCLUSIONS

1. A distinction in nomenclature should be drawn between substernal and intrathoracic goiter.

2. Morcellation of the tumor facilitates the removal and renders the procedure safe.

3. As in all goiter operations the finger should not be swept around the gland but the gland should be placed under traction with forceps. In this way the operation is not a blind operation and if the smaller organ is removed gradually anomalous vessels can be observed and ligated.

4. Morcellation can be accomplished by removing part or all of the tumor within the gland by blunt dissection. In some cases the radio knife can be used to advantage—gradually cutting away the center of the mass with the coagulating current.

5. The objection to morcellation, except in malignancy,[13] is answered by the statement that the operation is designed to cure the patient—not to save a good pathological specimen.

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SKIN GRAFTING IN MORIBUND BURNED PATIENTS

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IF a burn of the skin results in its complete destruction over an extensive area, progressive debility occurs, which is often difficult to control by medical therapy alone. In order to preserve life, it is imperative to resurface the exposed areas as early as possible. In addition to aiding the physiochemical processes of the body, early skin grafting impedes the rapid progressing inanition. If some of the deep epithelial elements are preserved, a superficial third degree burn may epithelialize rapidly and quite satisfactorily without the use of a skin graft. Undue conservatism and delay in anticipating spontaneous epithelialization, however, is wrong as extensive deep burned areas sometimes resist all efforts to stimulate epithelialization.

Severely burned patients should be isolated and treated in separate rooms as an obnoxious penetrating odor is emitted. In spite of the fetid odor, the dressings are not changed more often than every seven to ten days. An oil skin covering over the bulky pressure dressing helps to confine the malodor. Antiseptic deodorants are also useful. During the summer months, maggots may be found on the raw surfaces but are not detrimental.

The patient's general condition must be treated along with the local lesion. In the early stages of an extensive burn after the primary débridement, the entire therapy is directed toward measures for improving the state of the patient. There is a progressive depletion of the hemoglobin and plasma proteins. Hypoproteinemia and secondary anemia frequently develop despite all therapy. Vast amounts of protein are lost in the exudate from the burn surface and by the excretion of nitrogen in the urine. The protein loss and progressive anemia can be better controlled by pressure dressings and the early application of skin grafts whether homogenous or autogenous.

With the advent of the dermatome, the problem of resurfacing large defects has been considerably facilitated. Almost any part of the body may be used as a donor site, viz, arms, chest, abdomen, back, buttocks, thighs and legs. If only a limited amount of skin is available due to the vastness of a burn, the donor area may be reused or a homograft applied. If Thiersch or thin split-thickness grafts are employed, the sub-epithelial structures of the donor site are preserved and regeneration occurs. The donor site will be available for reoperation in about five weeks. Full thickness free grafts are not used in extensive burns due to the resulting donor defects and the long period required for their healing. Besides, the field in these cases is dirty and there is little chance for a thick graft to take.

Early grafting is highly desirous. The optimum time is inconstant and varies with each case. When all the devitalized tissue has been removed and the period of shock terminated, grafting should be carried out. The longer one procrastinates, the more progressive the anemia, hypoproteinemia and resulting debility. In extensive deep burns with marked infection, the wound may not be ready for grafting for six to eight weeks after the injury. In the presence of frank pus, grafting is never performed. Severely infected areas are surgically prepared by a daily change of dressing with the application of a thin coating of sulfathiazole powder, and a continuous wet pressure dressing of 1:3300 aqueous azochloramide. As soon as the area has assumed a clear

healthy appearance, grafting should be started even though tissue culture may show the presence of pyogenic organisms.

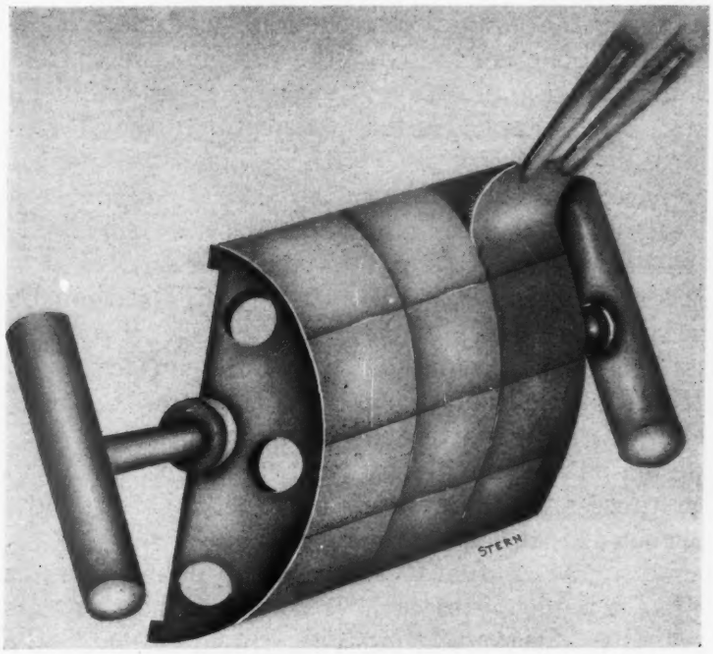


Fig. 1. Thin split-thickness graft patterned into squares on the dermatome drum.

If the operation has been delayed, soft friable exuberant granulations are present covered by a moderate granular discharge. This is no contraindication to skin grafting and the granulations are merely shaved down to their firm, yellowish base and the grafts applied.

The patient should be in the best possible physical condition before grafting. If a burn is extensive, however, the patient's state is usually poor. Anemia and hypoproteinemia are present and are not ideal conditions for skin grafting. Most surgeons tend to defer operation until the plasma protein level approaches normal and the hemoglobin is above 70 per cent. Unfortunately, it is often impossible to attain these levels in extensive burns despite repeated daily intravenous injections of amino acids and whole blood, liver, vitamin and iron therapy, and a high protein and high caloric diet. Anemia and hypoproteinemia are no contraindication to skin grafting when grafting is deemed necessary. In most instances, thin split-thickness dermatome grafts will take readily despite these adverse conditions.

A quick efficient method of saving life in extensive burns where the quantity of donor skin is limited, is to cut thin split-thickness dermatome grafts dividing them into squares. (Fig. 1.) These are then placed checker-board fashion on the raw surfaces. Poth[29] cuts his grafts by the dermatome, backs them with adhesive and then cuts them into squares or strips. Gabarro[15] applies the dermatome graft to stiff sticky paper and then patterns it into squares. Hardy[18] and McNichol use pliofilm cemented to the drum and Jenney[21] employs cotton bobbinets in a similar fashion. If very small squares are employed, the above technics are preferable. If larger squares are used, the direct transfer from drum to recipient site is more advantageous. After an interval of ten days, one may observe the circumferential proliferation of these grafts. Epithelium has been added to the denuded areas which grows in all directions until the spaces between the squares have been covered. A stabile pliable covering is formed. Checker-board grafts are used on large

exposed flat surfaces and are not employed over joints. Large free grafts are more suitable for the latter. Contractures are prevented by immobilizing the joint in optimum position after the application of a large free graft. If a bone is exposed, the cortex is drilled to produce granulations upon which a graft may be applied after the granulations have formed.

The patient is prepared, draped, and the cement is applied to the donor areas and dermatomes. When the cement is dry, gas and oxygen are administered and the grafts cut. The anesthesia is then discontinued. Two to four drums of skin may be cut in a few minutes with little or no shock to the patient. The grafts are patterned into squares on the dermatome simply by incising them with the scalpel. They are then placed checker-board style on the recipient site. When a square is lifted from the dermatome it has a tendency to curl. However, once applied to the granulating area this tendency disappears and the graft adheres to the surface. Suturing is unnecessary. With the application of a compression dressing, a complete take is almost assured. A vaseline gauze occlusion dressing is preferable to a dry compression bandage as it does not adhere to the graft when redressing the patient. The dressings are almost painless and only a minimum of bleeding ensues from the granulating non-grafted areas. Excessive oozing is undesirable as an anemia is already present. The bleeding which occurs from granulating areas at each change of dressing may be excessive unless a greasy non-adherent substance is used.

It appears logical to assume that the cutting of several grafts from a toxic burn patient would greatly increase the exposed body surface resulting in a more severe toxemia. Clinical observation has shown this not to be the case. Severely burned patients cachetic from extensive exposed surfaces have shown gratifying improvement following the third day of the application of grafts. The total denuded surface area has not been materially increased since the recipient site covered by these grafts is almost equal in size to the donor area. If a free graft is successful, it is fixed and has taken at the end of forty-eight hours. An exudate no longer forms so that the proteins are conserved. Patients show subjective and objective improvement. Subjectively they feel and look better and their appetites increase. Objective improvement is manifested by repeated blood counts. The hemoglobin and erythrocytes are not destroyed as rapidly as previous to the application of the grafts. The controversy as to whether a toxin from the burn surface or septic absorption is the cause for the anemia and hypoproteinemia has not been established as yet. However, spectacular improvement is noted soon after the application of the grafts.

Split-thickness dermatome squares are superior to pinch grafts. The operation is performed more quickly and is less tedious. The grafts are of uniform thickness and a complete take is almost assured. They have been found to take well in contaminated and even in moderately infected areas. They have even been successful in moribund patients with the hemoglobin as low as 30 per cent, a plasma protein level of 5, in the presence of infection. Although the cosmetic result of checker-board grafting leaves much to be desired, they are of advantage in requiring less skin, taking better and resurfacing large areas in a short time.

CASE REPORT

R. J., age forty, colored, a truck driver, ran out of gas on April 13, 1944. He purchased some, filled the gas tank and was pouring the remainder into the carburetor when the gasoline ignited and his right trouser leg caught fire. The flames shot up the right leg, across his abdomen, and down the opposite leg. The fire was extinguished by rolling the patient on the ground and he was admitted to the Beth Israel Hospital. Admitting examination revealed a well developed husky colored male not in apparent shock. His blood pressure was 130/100. The patient presented burns of both

legs, buttocks, penis, scrotum, lower abdomen and arms. These were believed to be second and third degree.

A primary cleansing débridement was performed by Dr. Meyer J. Cohen after scrubbing both lower extremities for ten minutes with soap, water, and saline. Vaseline gauze and a pressure bandage were applied. Laboratory examination revealed leucocytes 22,400, hemoglobin 140 per cent, and erythrocytes 5,960,000, a considerable hemoconcentration. The blood chloride level was 422, and the plasma proteins 6.1; 2,000 cc. of 5 per cent glucose in saline, 500 cc. of plasma, gas gangrene and tetanus anti-toxin sera were administered. Fluids were forced and opiates given to control pain. Due to the leucocytosis, sulfathiazole (1 Gm.) every four hours was given.

The patient's temperature remained normal and his condition apparently satisfactory until May 3rd (twenty days after admission), when the temperature suddenly rose to 102°F. The patient became irrational. The legs were redressed and examination revealed a severe cellulitis. A partial débridement of the whole skin was performed. The next day, further débridement was carried out, and the following day, May 5th, extensive débridement was performed completely removing the entire skin of both legs. A marked amount of free pus was found subcutaneously and between the layers of the muscles of the legs. Incisions were made in the fascial planes to allow the pus to drain. The temperature continued to spike to 102°F. despite adequate drainage. On May 7th, the temperature suddenly dropped from 102 to 96.4°F. The patient became pale, listless, and irrational, his pulse feeble, and his skin cold and clammy. He was apparently dying. Caffeine sodium benzoate, strychnine, coramine, an infusion and a blood transfusion were administered. The patient rallied and his condition greatly improved. On May 8th, continuous 1:3300 aqueous azochloramide wet dressings were started. On May 25th, the left tendon Achilles and the peronei muscles of both legs sloughed away. The anterior surface of the right patella and the anteromedial surface of both tibias were exposed. A large decubitus ulcer had formed over the sacrum and cocyx in spite of daily alcohol massages and a rubber nursing ring. Another large ulcer appeared over the right hip joint.

Additional therapy which had been administered since admission were daily intravenous injections of amino acids, a high protein and high caloric diet and repeated blood transfusions. The patient also received 6 tablets of feosol, 6 capsules of vitamin B complex and 200 mg. of ascorbic acid daily. Despite all medical therapy, a blood count on June 5th showed leucocytes 12,900, hemoglobin 30 per cent, and erythrocytes 2,010,000. Multiple cultures taken from both legs revealed Bacillus proteus, hemolytic streptococci and Staphylococcus albus. Blood cultures were negative, Wassermann and Kline tests were also negative.

On June 8th, fifty-seven days after admission, in spite of the positive tissue culture, a plasma protein level of 5, a hemoglobin of 30 per cent and a loss of weight of approximately 60 pounds, it was decided to attempt skin grafting. Medical therapy alone could not control the rapidly progressive depletion of the hemoglobin and the proteins. The operative report of June 9, 1944, is as follows:

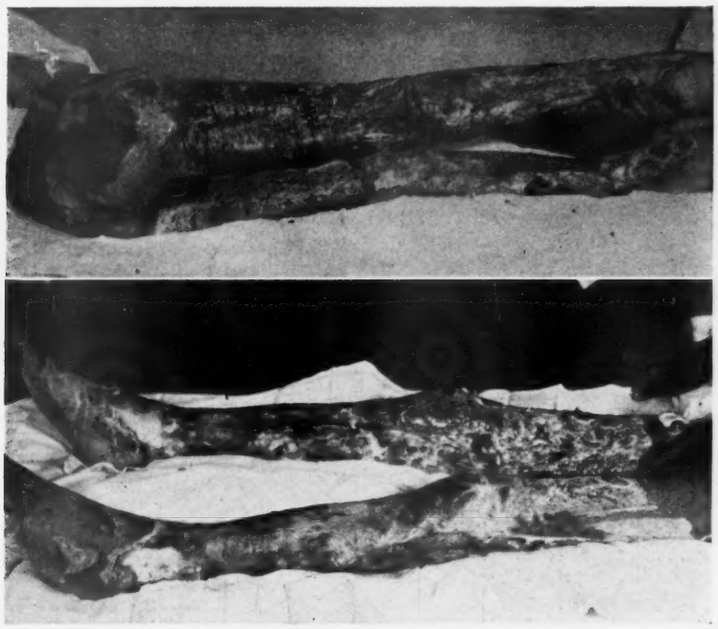
The defect consisted of third and fourth degree burns of the whole of both legs, both buttocks, and lower abdomen. The second degree burns of the penis, scrotum, and arms had healed completely. The anteromedial surfaces of both tibias and the right patella were exposed.

The patient's general debility prevented any extensive surgery so that it was deemed advisable to cut one graft administering only small amounts of gas and oxygen while cutting the graft. A dermatome graft .010 inch thick was cut from the abdomen and trimmed into squares. These were placed checker-board style on the ventral surface of the right thigh from below the inguinal ligament to an area above the knee joint. The right tibia was drilled to produce granulations. Sulfathiazole powder, vaseline gauze and pressure dressings were applied both to the legs and donor abdominal site.

The dermatome squares of the previous operation took completely. On June 23rd (fourteen days later), the patient was again brought to the operating room. Three .012 inch dermatome grafts were cut from the upper abdomen and chest wall. Two of these grafts were modeled around the right knee except in the region of the exposed patella. The third graft was cut into squares and placed checkerboard fashion down the ventral surfaces of the right and left legs on either side of the exposed

Fig. 2. A, preoperative photograph of extensive third degree alcohol burn of both thighs and lower abdomen. B, postoperative result two weeks after grafting. Three .016 inch dermatome grafts patterned to match the defect and sutured into place. C, postoperative photograph showing grafted left arm, grafted lower abdomen, and grafted thighs. The other burned portions of the abdomen, breasts, and chest healed spontaneously. Three .016 inch dermatome grafts patterned and applied to the left arm after releasing scar contracture. Three .016 inch dermatome grafts patterned and applied to both thighs and lower abdomen. D, donor sites. Three dermatome grafts taken from back five weeks previous to photograph. Three dermatome grafts taken from buttocks two weeks previous to photograph.

A



B

C D

FIG. 3. A and B, preoperative photographs of extensively burned legs. C and D, postoperative photographs three and one-half months after start of grafting.

tibias. The patella was drilled to produce granulations.

Three days after this operation the patient's general condition improved greatly. At the next dressing, it was found that the ventral surface of the left thigh down to the knee had epithelialized spontaneously. On July 14th (three weeks later), the third plastic operation was performed.

board grafts had progressed rapidly and satisfactorily. The lower one-third of both tibias were still exposed. The fourth plastic operation was performed two weeks later on July 28th.

The anteromedial surface of the left tibia was drilled through the cortex to produce granulations. Two .012 inch dermatome grafts were cut from the right side of the chest. These grafts were patterned to match the remaining

TABLE I

SUMMARY OF OPERATIONS AND SELECTED PERTINENT BLOOD COUNTS

	4/14	4/18	4/20	4/27	5/8	5/16	6.5	6/9	6/10	6/13	6/17
Hemoglobin	140%	101%	82%	68%	64%	72%	30%		39%	51%	39%
R.B.C.'s (Millions)	5, 9	4, 8	4, 3	3, 4	2, 6	3, 6	2, 0		2, 1	2, 7	1, 7
W.B.C.'s (Thousands)	22	11	18	20	20	8	12		10		
Operation								One drum .010 in. thick			
Take								Complete			

	6/23	6/24	7/1	7/8	7/14	7/15	7/19	7/23	7/28	7/29	8/4
Hemoglobin		40%	63%	59%		51%	45%	42%		50%	66%
R.B.C.'s (Millions)		2, 8	3, 7	2, 9							
W.B.C.'s (Thousands)											
Operation	Three drums .012 in. thick				Four drums .012 in. thick				Two drums .012 in. thick		
Take	Complete				Complete				Complete Last Blood Transfusion		

	8/7	8/18	8/23	8/26	8/30	9/8	9/16	10/5	10/27	11/16
Hemoglobin	74%	66%		63%	64%	62%	70%	78%	82%	94%
R.B.C.'s (Millions)										
W.B.C.'s (Thousands)										
Operation			Two drums .016 in. thick							
Take			Complete							

The patient was emaciated and his ribs and vertebral column were very prominent making it difficult to cut the grafts from the back. Four dermatome grafts .012 inch thick were cut from the back. Two of these grafts were sutured over both popliteal fossae. The remaining two grafts were cut into squares and placed checkerboard style over the dorsal surface of both legs and thighs.

The grafts from the previous operations took completely. Epithelialization from the checker-

defects and were sutured to the lateral side of the right leg and upper medial side of the left leg.

By August 22nd, the whole of both legs were covered except for small areas of the exposed tibias and the ankles. Exuberant granulations were present around both ankles. The patient was operated upon for the fifth time.

The exposed areas of both tibias were drilled through the cortex of the bone. Exuberant granulations around both ankles were shaved

down. Two split-thickness dermatome grafts .016 inch were cut from the lower abdomen. These grafts consisted of regenerated skin following the previous operations. The grafts were patterned to match the defect and were laid in place without suturing. A pressure dressing was applied.

Reference to the operative reports (Table 1) will show that dermatome grafts either in the form of whole grafts or squares will take successfully in severely burned patients with marked anemia. (Figs. 2 and 3.)

CONCLUSIONS

1. A case of a severely burned patient moribund from toxemia, anemia, and hypoproteinemia is described in which extensive free grafting was successful even though the hemoglobin was below 50 per cent and the plasma protein level at 5.

2. A quick efficient non-shocking method of resurfacing extensive flat raw surfaces is to employ thin split-thickness dermatome squares in a checker-board fashion.

3. Thin split-thickness dermatome squares will take in moribund patients with the hemoglobin as low as 30 per cent and the plasma protein level as low as 5 in the presence of infection.

4. Split-thickness dermatome squares are highly economical in that large areas may be covered with a minimum quantity of skin.

5. Split-thickness dermatome squares are superior to pinch grafts in that they may be cut more quickly, are of uniform thickness, and take better.

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Pedicled skin grafts may be classified as simple, compound, and lined. A simple graft is composed of skin and subcutaneous tissue. A compound graft contains skin, subcutaneous tissue, and bone, cartilage, or muscle. A lined graft is a simple graft, the undersurface of which is covered with epithelium by folding the pedicle or by applying an Ollier-Thiersch graft.

From "Operations of General Surgery" by Thomas G. Orr (W. B. Saunders Company).

TECHNIC OF CONTINUOUS PENTOTHAL ANESTHESIA

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THE purpose of this paper is to present a method for the administration of intravenous anesthesia. The method was designed especially to accommodate an overwhelming flow of cases with a minimum of personnel and equipment, such as would be met in a combat zone. The technic embodies mechanical aids to allow the anesthetist greater freedom and ease in administration to a single patient, or the simultaneous administration to several patients if this is necessary. The method is not entirely new, and other methods may be found equally effective[1,2,3] but the equipment described here is made of such readily obtainable material that its war-time production is feasible, and its loss would not prove costly. Its compact form makes for ease of transportation, which should prove of greatest value to mobile surgical groups. The technic of administration requires a minimum of sterile equipment, allowing an uninterrupted flow of patients with practically no re-sterilization of material. The plethora of detail is meant as no insult to the intelligence of the experienced anesthetist, but merely as step-savers for the uninitiated. However, variation in equipment or technic may be made to suit the individual anesthetist.

THE ARMBOARD

As illustrated in Figure 1, the armboard[4] is made of wood, is 36 in. long and 4 in. wide, and is hinged at its center so that it can be folded and thus more easily packed. It is tapered, to permit its easy insertion beneath mattress or blanket, beginning the taper well out on the bottom side, so that it will fold flat. It is varnished to facilitate cleaning. A small block, with pegs as illustrated, is used to hold the syringe. There are several holes on each side of the board to enable the block to be placed in several positions as may be desired. When the board is folded, the pegs are placed in holes in the flat of the board as shown, again with the objective of compactness. The set for a mobile surgical team should include two boards so that two tables may be operated simultaneously.

To fasten the syringe to the v-shaped groove in the end of the block, a headless nail is driven through the block in about its center, notches are cut beneath the nail ends which are then bent down into the notches. Thus there are no protruding ends to catch the patient's arm. The syringe fastener consists of about 4 inches of narrow rubber tubing, (from the U.S. Army plasma set) into either end of which an "8"-shaped piece of wire is tied. The protruding loop is hooked over the bent nail on either side as illustrated. This single strand of rubber tubing will be found quite sufficient to hold the syringe firmly in place.

A narrow canvas strap (1 inch wide) with a simple buckle, will be found convenient to hold the patient's arm in place on the board. It is best to run the strap over the palm of the hand, for here it may be tied snugly without impeding the circulation, and it will also prevent the patient from bending his wrist and striking the syringe with his fingers. It may be tacked, near the buckle, to the bottom of the board an inch or two from the end.

An objection that has been made is that any armboard would be inconvenient if not impossible to use when an army stretcher is used as an operating table. The objection is based upon the fact that the concavity of the canvas would either

make the board extend at too steep an angle, or prove uncomfortable beneath the back of the patient. By placing one or two folded blankets or a pillow beneath the shoulders and head of the patient, and inserting the armboard between them, this objection is overcome. On an ordinary operating table it is inserted with great ease between mattress and table.

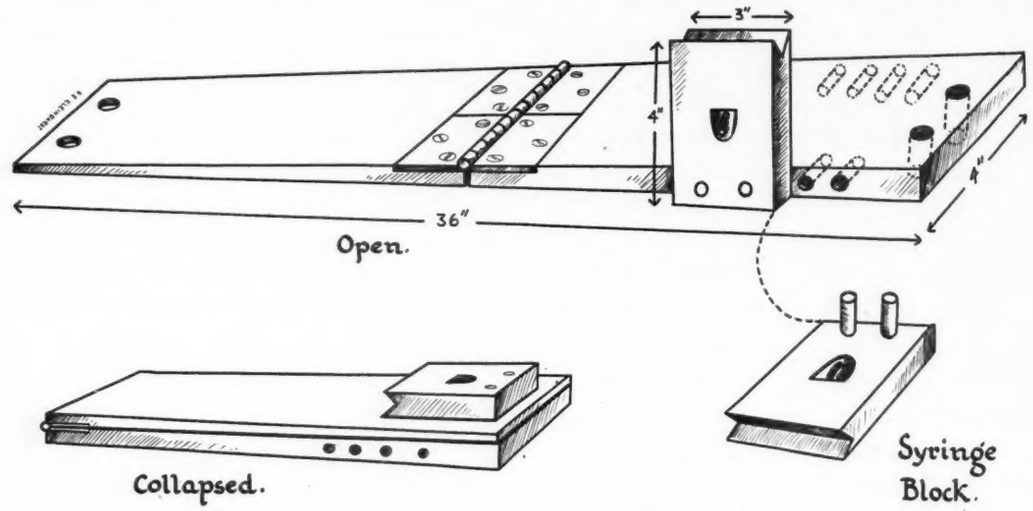

FIG. 1. Intravenous anesthesia arm board.

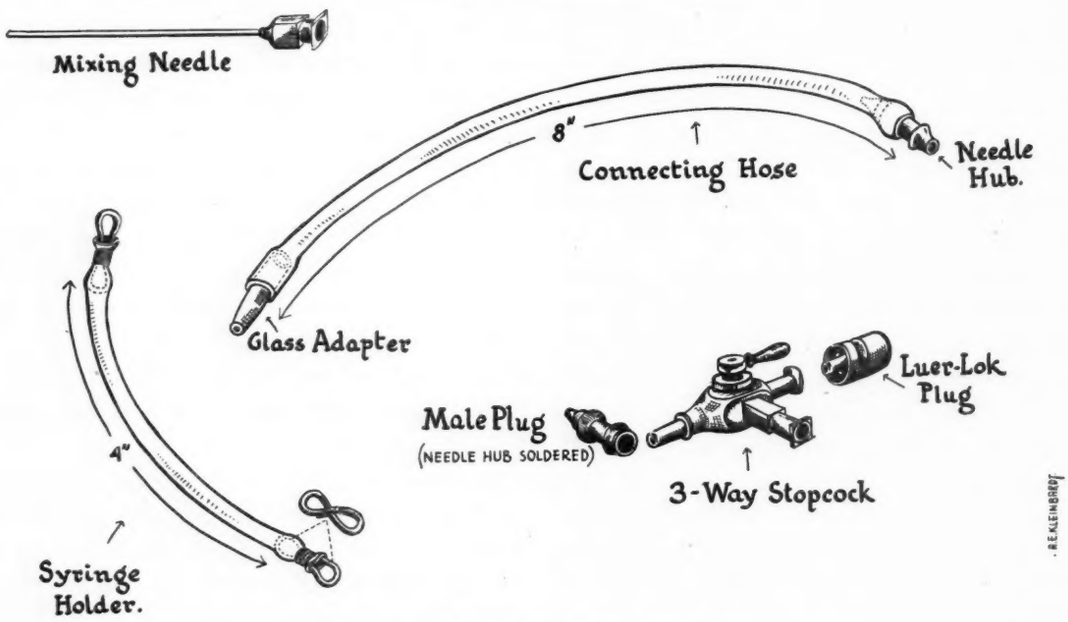

FIG. 2. Intravenous anesthesia equipment.

THE INTRAVENOUS EQUIPMENT

A three-way stopcock is essential for the most efficient use of this technic. The best stopcock encountered (Fig. 2) has been a standard B-D with the following alteration: The standard stopcock has one male and one female Luer-lok connection, and one ribbed projection to take a rubber hose. This ribbed projection is removed and a female Luer-lok connection welded in its place. It will thus take the adapter of an infusion or plasma set, or a Luer-lok plug (Fig. 2) to close this opening for short administrations where an infusion is not desired. Thus, in effect, the stopcock is either a two- or three-way stopcock. But any three-way stopcock with Luer fittings can be used. Two stopcocks should

be included in a set, but a third may be necessary because a stopcock may go out of order.

The syringe used is the standard army 30 cc. one, and three syringes are all that are necessary to run two tables, although several others should be included in the set to provide for breakage. Two mixing needles, made by filing the bevels off of long No. 15 gauge needles, will be found valuable.

The connecting hoses (Fig. 2) are made from the narrow bore, transparent rubber tubing found in the plasma sets. The female connection at one end is made from a needle hub, a rounded hub being most satisfactory, and the glass adapter from the plasma set is used at the other. The length of the hose is about 8 inches, although several hoses of extra length should be included for cases in which the patient is on his face or in some other awkward position. At least a dozen of these hoses should be included, although more may be found convenient, for it is about this point that the efficiency of the technic pivots. The rubber should be replaced periodically.

A saline infusion, although plasma or blood can be substituted, is set up at each table. A plug (Fig. 2) made by soldering the opening of a needle hub, as described by Lundy,[5] may be used to close the male nipple of the stopcock between cases and also protect it from contamination. This plug will be found very useful to close and protect syringes and infusion adapters in all stages of operation, and several extra plugs should be included in each set. Instead of the breakable glass adapter, the metal adapter from a broken syringe is advantageously tied into the infusion hose.

TRAY SET-UP

The tray, stand, table, or end of a packing case, which is used as a work bench need not be sterile. As illustrated in Figure 4, the only sterile part is the folded towel, placed in a small pan for convenience, in which is kept the stock of sterile connecting hoses and needles. A small dish filled with alcohol is used to contain plugs and stopcocks. A sterile hemostat is placed with its end in the alcohol and used to remove connecting hoses, etc. The remainder of the working surface does not need to be sterile, for the syringes are protected by plugs and the sponges and ampules are surgically clean. It will be convenient to keep the ampules in a stand if this is available. A waste container is not essential. This set-up is placed convenient to the operating table, or between the two tables if such is the case, and if the working surface is large enough, may be used to hold the armboard between cases.

TECHNIC OF ADMINISTRATION

The syringes, needles, stopcocks, plugs and connecting hoses are sterilized by any suitable means. Autoclaving is best, and should be done before becoming active, but boiling, or even submersion in 95 per cent alcohol will suffice if necessary. The lot is placed in the sterile folded towel which is placed in the pan. This then becomes the reservoir from which the items are drawn as required. A fresh supply of connecting hoses and needles is sterilized for each twenty-four hours' work, but the plugs and stopcocks may be left in the alcohol.

At the onset of an operative list each of the three syringes is filled with a 2½ per cent solution of pentothal. It should be noted here that if the mixing needles are left standing in the empty ampules, they will remain sterile for their next use. A central reservoir of pentothal may or may not be used. The stopcocks, with plugs in place, are connected to two syringes and the third is kept in reserve, plugged and thus left with safety on the "contaminated" part of the tray.

This method does not contemplate the use of an anesthetic room. Induction can be easily accomplished in the operating room after the patient has cooperated in adjusting himself to the best position on

the table. The patient will be ready for the "prep" in one minute, no time is lost, and the fear that he will suffer psychologi-

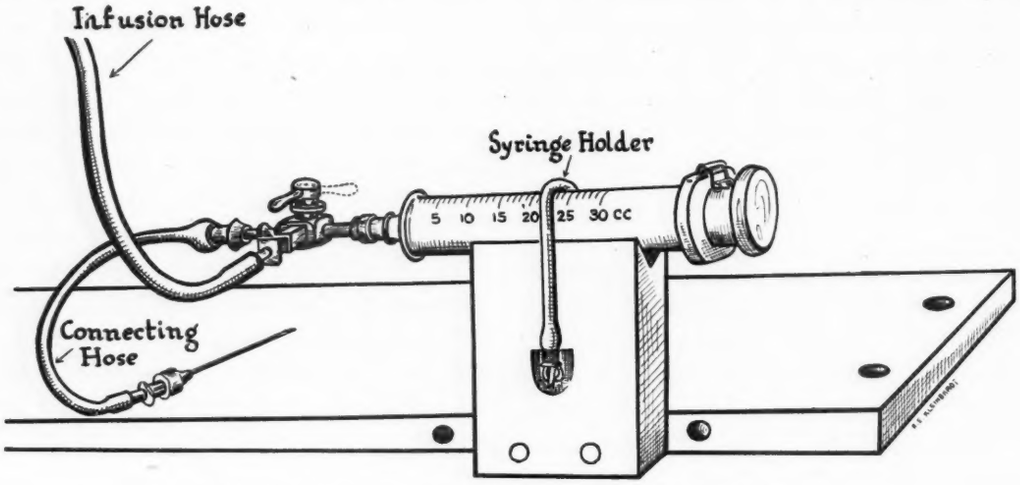

FIG. 3. Intravenous anesthesia equipment assembled.

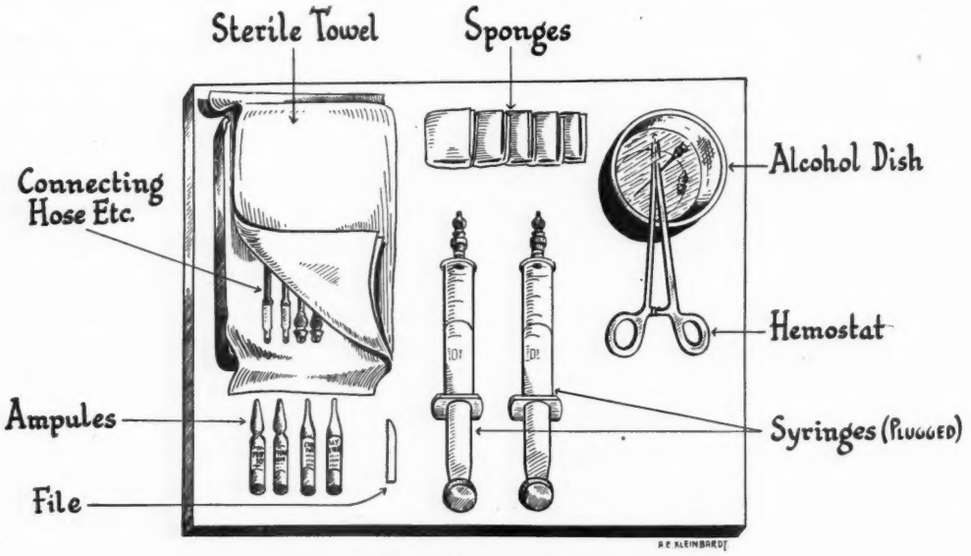

FIG. 4. Tray set-up.

cal shock on entering the operating room awake, is found on actual practice to be practically non-existent. Of course, in the tent operating room, as many as six tables may be in operation at once and there is no possibility of an anesthetic room.

When the patients come in, an armboard is adjusted for each, padded with a towel, and the arm is gently tied in place with the strap. The syringe and stopcock are then fastened firmly on the block. The Luer-lok plug is removed from the stopcock and the adapter of the infusion set put in its place. The other plug is replaced by a connecting hose and needle. Both plugs are then placed in the dish of alcohol. The connecting hose is filled with the saline from the infusion. The purpose of the saline infusion is to keep the needle open. The stopcock is turned to a half-way position to shut off both infusion and syringe, and all is ready.

The needle is first inserted in the vein and taped securely in place. The infusion is now allowed to run by turning the stopcock to the proper position. A rate as slow as 40 drops per minute is more than sufficient to keep the needle open. To start the

anesthetic, the stopcock is switched to the syringe, automatically stopping the infusion, and pentothal is injected. When the patient is in the desired plane, the stopcock is switched back to the infusion. In estimating dosage, remember that the connecting hose contains about 2 cc. of pentothal which will be carried into the circulation when the infusion is again allowed to run. The anesthetist is now free to adjust the air-way, administer oxygen or nitrous oxide, or attend to any other tasks required of him. He needs no assistant. From time to time he may inject more pentothal as required. As one syringe is emptied, it is disconnected from the stopcock and a full syringe substituted, the emptied syringe being refilled and plugged.

Upon the conclusion of the anesthetic, the infusion is stopped by switching the stopcock, to half-way position, and the needle is withdrawn from the vein. The used connecting hose is removed from the stopcock, whose nipple is protected and plugged by a sterile plug taken from the alcohol. The armboard is now gently withdrawn from beneath the patient, the syringe, etc., remaining in place, and then readjusted beneath the arm of the next patient when he is brought in. A fresh, sterile connecting hose and needle is attached, and all is ready for the next administration. This is possible without any break in sterility since the patient's blood has never flowed further back than the connecting hose.

Thus the only piece of equipment to be resterilized between cases is the connecting hose and needle. If enough of these are on hand there will be enough for a complete series of cases without any resterilization whatsoever. The syringes do not come into contact with the patient, and are merely used in rotation to mix pentothal solution. Pentothal left over from one case may be used for the next. The same infusion may be used for successive patients since that part of the apparatus is not contaminated either. The adapter of the infusion hose is plugged between patients. If blood or plasma is necessary in the course of any anesthetic, the saline is discontinued while the blood or plasma is running. The saline should be used to wash out the stopcock before the next administration.

This method has been used by the author in both American and British hospitals in England during the year before invasion. At this writing it has had vast use on battle casualties in France, Belgium and Germany. It has been the method employed in about 80 per cent of all anesthetics administered. It has been used by the author and a number of his fellow anesthetists, in an amphibious clearing station, evacuation, general and field hospitals. It has proved quite satisfactory from the point of convenience, safety, and economy of time and material. No untoward complications have arisen. It enables the anesthetist to administer two anesthetics simultaneously; and, since the majority of cases are relatively superficial debridements, it saves much valuable time.

SUMMARY

A method for the administration of intravenous anesthesia is presented. It has proved especially useful in the field since the equipment is compact and easily obtained, but it has been found to be effective in any operating room. A minimum of sterilization is necessary. The anesthetist can easily administer successive and simultaneous anesthetics, and be free to administer oxygen or oxygen and nitrous oxide or give plasma and blood if necessary.

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INGUINAL HERNIORRHAPHY

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INGUINAL herniorrhaphy is one of the most common operations but it is not one of the most successful.[1] It may well be called one of the unsolved problems of surgery because there is a distressingly high percentage of recurrences.[2] Since the technical performance of the operation is not thought to be difficult and the risk is low, many doctors attempt this unsolved problem who hesitate to assume the responsibility of operations like thyroidectomy. Theoretically, inguinal herniorrhaphy should be 100 per cent successful when done as an elective operation.[3] Even relatively unavoidable surgical hazards such as wound infection and pneumonia are not conspicuous causes of failure.[4] We believe recurrence is usually the result of a fundamentally defective operation. The cure of inguinal hernia is essentially a problem in plastic surgery and the principles of plastic surgery apply.[5] Among these are (1) the use of grafts, (2) the use of non-absorbable cotton suture material,[33] (3) avoidance of tension on the sutures, and (4) providing adequate rest time for healing. In recent years considerable progress has been made along these lines and the operation as now performed is significantly different from that done five years ago.[6] Although there have been no recurrences on an active surgical service of over 500 herniorrhaphies in the past year, our follow-up is admittedly inadequate. Furthermore most of the operations have been on active healthy young men who are not fair test material for any method of herniorrhaphy.* Accordingly we do not present statistical proof of the methods advocated. Rather the operation is based logically upon principles established in other fields of surgery, anatomy, and physiology.[7,8]

Ordinarily the mere existence of an inguinal hernia is the necessary indication for herniorrhaphy. Occasionally a patient will present a small, visibly bulging direct hernia which is asymptomatic and which may have been present for years. Apparently it is possible for such hernias to remain non-progressive for many years if the external oblique fascia is strongly supportive and herniorrhaphy is unnecessary. The mere presence of an enlarged external inguinal ring does not establish the diagnosis of hernia, nor in fact does an enlarged ring even predispose to the subsequent development of a hernia. Some indirect hernias are inconstant and remain reduced for days at a time. The history of bulging is unreliable and operation should be delayed until the surgeon himself can observe the hernia. The diagnosis of small incomplete hernia is sometimes made possible by palpating a characteristic thrill over the inguinal canal after a cough. The omentum enters the hernia sac during the cough and can be felt to slip back into the abdomen if pressure is applied by the hand directly over the canal immediately after a cough. Particular contraindications to elective herniorrhaphy are a chronic cough and skin irritation in the inguinal region. Some smokers have to reduce their smoking for a month and occasionally an irritating truss has to be discarded for a while preoperatively.

Spinal anesthesia with its complete relaxation is so desirable as practically to leave no second choice. Procaine in high concentration to obtain paralysis will usually be satisfactory although we commonly use the longer lasting metycaine and occasionally pontocaine for bilateral

* This article was written while the author was Chief of General Surgery of a large Army Hospital.

operations. The freedom from postoperative vomiting is an additional virtue of spinal anesthesia as some herniorrhaphies are broken down immediately postoperatively by the violent retching of a semiconscious patient.

Bilateral herniorrhaphy is permissible unless the first and worst side takes over an hour. We no longer feel justified in exploring the other side routinely, although a plastic operation on one side does not affect the other inguinal region.[9] The morbidity of the bilateral operation is increased but not doubled. Bilateral hernias often are larger and more difficult to repair, but otherwise there is no reason for expecting a bilateral repair to be less successful than two repairs at separate operations. If the appendix can be completely and easily delivered into the wound, the appendix is removed but usually it is merely explored with the finger.

The skin incision is located by placing the finger in the subcutaneous inguinal external ring. It is made parallel to the inguinal ligament directly over the spermatic cord and extended far enough medially to expose the external ring completely. The several subcutaneous blood vessels can often be caught in small pointed clamps before cutting. These are tied with No. 80 plain cotton white thread taking care to include only the vessel and to avoid creating tufts of strangulated fat.[10] The incision with the knife is carried down through the external oblique aponeurotic fascia at the middle of the external ring. The fascial fibers are separated laterally to expose the cord. The use of scissors to separate these fibers is unduly hazardous to the ilio-inguinal nerve and its branches. These nerves are inconstant and often very bothersome but are respectfully preserved. They are very susceptible to stretching by rough retraction. The two edges of the incision in the external ring are caught by two Carmalt clamps for retraction and as markers. The Carmalt clamp is the least traumatic type of clamp available but should not be too tightly closed.

The cord is then elevated by scissor dissection down toward the spine of the pubis.[11] If this dissection is done rapidly and accurately, one has the advantage of a clear field unstained by blood. There is usually one branch of the inferior epigastric artery on the posterior surface of the cord which requires tying. A broad thin rubber drainage tube is slipped under the cord for retraction. Bundles of the cremaster muscle often arch down from the cord medially to the internal oblique muscle. These bundles are cut close to the internal oblique muscle allowing the loose ends to fall back along the cord and the cord is elevated all the way up to the abdominal, inguinal internal ring.

The cremaster muscle is then incised longitudinally with the knife for about 1½ inches just below the superior border of the internal ring on the anteromedial aspect of the cord. With the cord elevated and held on one finger it is explored through this incision. Exploration lower than this will sometimes fail to reveal a short sac. The congenital sac of indirect hernia is always immediately adherent to the ductus deferens as it leaves the abdomen. If no sac is found, the peritoneum is opened at this site anyway.

The inguinal region of the abdomen is then explored. Unsuspected femoral hernias are occasionally found. Most important, however, is the estimate of the direct hernia defect. The essential characteristics of direct and indirect hernias should be kept clearly in mind. The inferior epigastric artery is often taken as the distinguishing landmark but really whether the bulge is above or below this artery is incidental. An oblique indirect hernia follows a congenital preformed sac of incompletely obliterated vaginal process of the descending testis. A direct hernia bulges through a weak area bounded above by the upper border of the internal ring and laterally by the inguinal ligament. The medial edge of this defect is formed by the arching

fibers of the internal oblique and transversalis muscles and fascias. These arching fibers sometimes close snugly under the preformed sac are both parts of a single developmental defect, but regardless of their origin the observed fact is that they

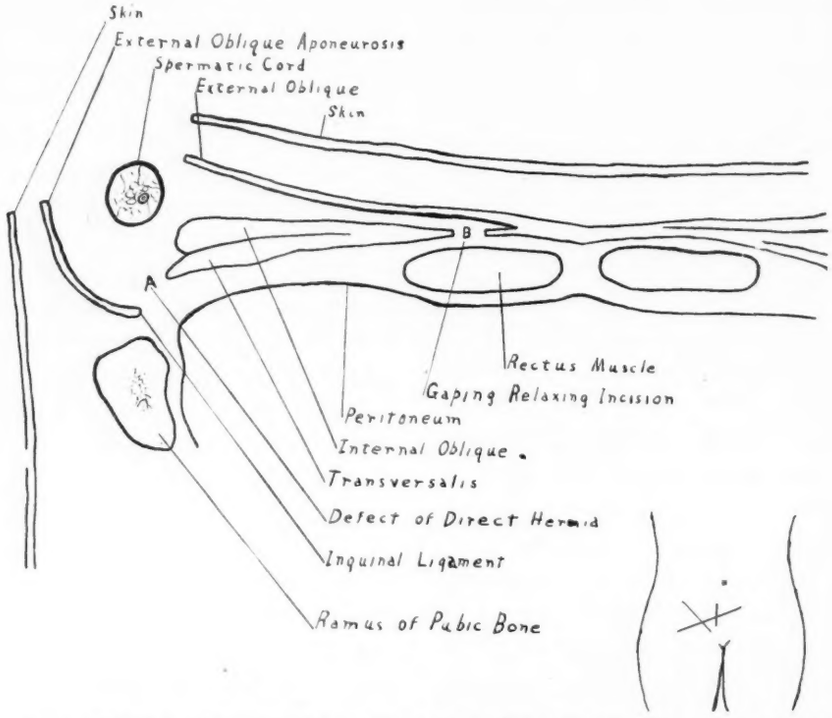

FIG. 1. Diagram of cross-section through the direct hernia defect (A) and the relaxing incision in the anterior rectus sheath (B). The tissue between A and B constitutes a sliding graft to close the defect A. The insert shows the line of the inguinal incision, the site of the relaxing incision, and the plane of the cross-section.

cord over to the inguinal ligament forming a tight circular internal ring, but commonly they arch down lower, even to the spine of the pubis forming an oval and defective internal ring. This medial edge is very easily identified by the exploring finger within the abdomen but almost impossible properly to appreciate from the outside. Every indirect hernia, therefore, has a direct hernia component. An indirect hernia emerges along the prepared avenue of the congenital sac which serves as an entering and dilating wedge but the defect in the abdominal wall is the same as that for a direct inguinal hernia. Sometimes this defect is merely an enlarged internal ring stretched by the radial expansion of the mass of the indirect hernia but usually it is a definite weakness of the region below and medial to the internal ring. Perhaps this direct weakness and the co-exist and deserve separate consideration in the operative repair of every inguinal hernia.[12]

The sac is then stripped. If it extends down around the testicle, the sac is excised at the reflexion of the visceral tunica vaginalis. This dissection follows the sac closely and is facilitated by dissecting against the tip of an inserted index finger. The loose alveolar tissue is wiped off the sac with gauze while the assistant snips judiciously with scissors at adherent points. Clamps on the sac for traction usually pull off but control of the sac is easily maintained by holding it under some gauze between the thumb and the base of the index finger. Any bleeding veins are carefully tied because hematomas readily form in the loose tissue of the cord. The entire dissection of the sac is carried out through the short incision in the cremaster.

If the testicle has had to be pulled up into view, it is accurately replaced by grasping its lower pole with a long curved Carmalt clamp and poking it down into place. The testicle is carefully observed as it is pulled out of the scrotum to avoid confusion in its reposition. The testicle may be erroneously replaced with torsion, subcutaneously into the scrotum, or back into the perineum unless due care is taken.

If no indirect sac is found, the direct sac is pulled up through the same incision in the cremaster and stripped.[13] Even when an indirect sac is present there is usually also some redundancy of the periotoneum down toward the bladder ("pantaloon sac"). This redundancy is pulled up along with the indirect sac and the preperitoneal fat dissected off. The bladder is often pulled into view. The inferior epigastric artery is sacrificed if necessary. The direct sac is merely a secondary result of the direct hernia bulging through the defect in the abdominal wall and is not a significant etiological factor like the congenital sac is in indirect hernias.

If the omentum has been in the sac, it is gently pulled out of the abdomen as far as it easily can be and amputated. It is doubly clamped and cut in eight or ten pedicles, which are tied with No. 60 cotton thread leaving minimal tufts to form adhesions. We believe that the omentum is a contributory cause of hernia. Many patients with a complete congenital sac never develop the hernia even through the strenuous period of childhood until in the third decade when the omentum has grown long enough to act as an entering wedge. Patients with bilateral congenital sacs sometimes do not develop the second hernia as long as the omentum is held on the first side. The omentum is much more fluid than the bowel and more easily enters any hernial defect and especially an indirect congenital sac. After amputation it may hypertrophy again. We believe its importance as an organ of defense against infection has been exaggerated and have never regretted removing it.[14] No doubt many other surgeons have removed the omentum similarly during herniorrhaphy especially when it was adherent in the sac but we have not been able to find elsewhere in the literature such a discussion of its etiological rôle nor anyone advocating its routine amputation as we do. Appendectomy is also done at this time if it is indicated.

Before the sac is closed the stitches to close the direct hernia defect are placed with the index finger in the abdomen as a guide. If there is much redundancy of the preperitoneal fat and fascia, it is gathered in a row of six interrupted stitches of No. 40 cotton. These stitches need not include the inguinal ligament nor attempt to obtain firm fascia medially. This first row of gathering stitches is placed and tied. Then a second row of stitches is placed beginning at the pubic spine to approximate the inguinal ligament and the medial edge of the defect. If the inguinal ligament is attenuated or if there is any suggestion of a femoral hernia Copper's ligament is used as the lateral anchor for the lower part.[15] Cooper's ligament is in some respects a more physiologic lateral edge for this deeper suture line than the inguinal ligament. It is serviceable only as far laterally as the femoral vein which must be clearly exposed to avoid accidental puncture. The medial edge must be accurately identified, too. Sometimes the muscle fibers of the internal oblique extend nearly to the spine of the pubis and obscure it. These muscle bundles must be retracted medially or separated bluntly and no more than necessary to expose the white transversalis fascia below. Any red muscle included in this stitch will cut through and the area will be weakened. The glib textbook phrase "sew the conjoined tendon to Poupart's ligament" sounds deceptively simple. "Conjoined tendon" is a very inaccurate description of the tissue usually found at the medial edge of the direct hernia defect. A big stitch through the inguinal ligament and then through a big bite of tissue in the conjoined tendon area

pulls those structures together but does not hold them together for long because the stitch cuts through the red muscle part of the "conjoined tendon." We believe this to be the commonest technical error of herniorrhaphy and the largest single reason for failure. It is worse than useless to attempt to sew red muscle to white fascia because the muscle will cut through and the area will be weakened instead of strengthened. The stitches should be made with No. 40 plain white cotton and are placed every 8 to 10 mm. up to the internal ring. Unless the cord is very small it is separated into two bundles by blunt dissection and two of the stitches are taken through it creating in effect two internal rings (Torek).[16] No stitch is taken above the ring as the natural upper edge of the ring usually is very satisfactory firm tissue and cannot be improved upon.[17] Its muscular sphincter action should not be impaired. These stitches are taken with 15-inch strands of thread, clamps are placed on the ends and they are not tied until the sac is closed.

When the guiding finger inside the abdomen is no longer necessary the sac is closed. The peritoneum of the sac is pulled up firmly and an internal purse-string suture of No. 30 cotton is placed in the peritoneum at the level of the internal ring. When this is tied the peritoneum is closed smoothly. A second reinforcing transfixing ligature is applied to the stump of the sac and the excess amputated. This closure then retracts naturally up under the superior border of the internal ring. Efforts to fix it up there with a stitch through the muscle are unnecessary and usually involve undue tension. The previously placed stitches in the direct hernia defect are then tied. The clamps on the stitch threads are pulled up firmly by the assistant closing the suture line while the stitches are tied successively from below upward and thus each stitch is tied without tension during the knotting.

A narrow strip of the fascia of the medial edge of the incision in the external oblique is then split off leaving the upper end attached. The lower end is threaded into a Gallie needle and is sutured in place as a graft to reinforce the internal ring (MacArthur).[18] The needle enters the internal oblique muscle at the medial border of the internal ring, pierces the cord through the above mentioned separation, catches the inguinal ligament, crosses back below the cord to another bite in the medial edge, pierces the fascia strip itself as it again goes through the cord, again catches the inguinal ligament, and then is threaded up through the internal oblique muscle above the ring to be sutured to itself with a cotton stitch. If this figure-of-eight graft is not pulled too tightly, it will not cut through the muscle but survives as strong tissue.[19] Sometimes the natural hood-like effect of the internal oblique muscle over the internal ring may be accentuated by a stitch from the superficial fascia on the anterior surface of the internal oblique muscle over to the inguinal ligament. The incision in the cremaster muscle is then closed with four stitches. Careful gentle dissection and suturing will have preserved the integrity of the cremaster muscle and the cord even with dissection of a sac down around the testicle.

This type of operation will cure most small hernias. The high suture closure and amputation of the sac cures indirect hernias and recurrence of indirect hernia is only possible if the sac is not tied high enough or missed entirely. Aside from these gross errors any recurrence must be a direct hernia by definition and the distinction is important. Conceivably a direct hernia could exit through the internal ring and dissect itself down along the cord, but it would still be essentially a direct hernia when considered as a surgical problem. In fact, as should be apparent from the above discussion, we consider all inguinal hernias to be essentially direct hernias when considered as a surgical problem. The exception to this is the repair of congenital inguinal hernias of infants. Simple removal of the sac seems to cure these and since the

cord in infants is so easily injured such extensive dissection and suturing as we have described is not necessary or desirable.

Fascia lata suture-graft from the thigh is indicated to close the direct hernia defect if the hernia is a recurrence, if the defect is large, if the patient is obese, if the tissues seem weak, if the exploring finger cannot definitely outline the medial edge of the defect, or if the patient has a chronic cough.[20,21,22] This entails slight additional risk although we have never had a complication arise in the thigh wound.[23] Cutis graft may be used instead of fascia lata.[24] Every patient is draped so that fascia lata can be used whether the original plan of operation included it or not. We use a Masson fascia stripper through a small incision below and anterior to the greater trochanter.[25] Wounds heal from the sides and not the ends so a long incision in the thigh to obtain the fascia is perfectly permissible if no fascia stripper is available.[26] A strip ¾ by 12 inches is easily obtained and splits into three adequate sutures. The tear in the fascia lata need not be closed.[27] The fascia lata sutures are used instead of the above described row of sutures approximating the two edges of the direct hernia defect and the strip of fascia from the external oblique. The fascia is really not as much a suture to approximate the two edges as it is a graft bridging across the defect with a lattice-work crosshatching.[28] The fascial suture is prepared by firmly tying each end with a cotton suture. Then a small Gallie needle is threaded on the upper end, backed on about an inch, the point of the needle is pierced through the fascial suture just proximal to the terminal tie and pulled on through. The first stitch is taken and caught as a loop by sewing the needle through the strand just proximal to the tie in the other end. Subsequent weaving of the stitches is accomplished by frequently sewing the suture through itself. The fascial suture is carried up around the upper border of the internal ring and the cord may be carefully pierced in two or three places. The needle should bite deeply into the medial edge and it is unnecessary to avoid including red muscle in the stitch since it is not pulled too tightly and does not cut through. The lower part of this graft can be placed with the finger inside the abdomen but before it is completed the sac must be closed as described above.

When the direct hernia defect has been closed, the result is palpated and the amount of tension is evaluated. In most cases a relaxing incision is desirable to create a sliding graft of the conjoined tendon area.[29] This is a three inch sagittal incision in that part of the anterior rectus sheath formed by the internal oblique aponeurosis. (Fig. 1.) It is made with the scissors from the pubic bone upward just lateral to the fusion of the internal and external oblique aponeuroses. The external oblique fascia is retracted strongly upward by the assistant and the two aponeuroses separated as far medially as possible. There is usually one small branch of the inferior epigastric artery which has to be tied. The lateral edge of this incision retracts laterally and any tension on the suture line relaxes. The lateral edge is usually left loose but it can be caught with four or five stitches to the overlying fascia of the external oblique. If this incision is made earlier in the operation, it is more difficult to identify the medial edge of the hernia defect. Halsted suggested folding the lateral edge of this relaxing incision over to the inguinal ligament.[30,31] It seems more rational to use the tissue as a sliding graft than as a reflected graft. The defect created by this incision is amply covered by the rectus muscle posteriorly and the fascia of the external oblique anteriorly.

The external oblique fascia is then closed. It is usually desirable to narrow the external ring. Remembering the size of the original external ring marked by the two Carmalt clamps makes it easy to judge where to place the first and lowest stitch. The medial edge of the fascial incision is than snugly overlapped on top of the lateral sheet with mattress sutures

of No. 40 cotton along both edges. All sutures are placed before tying. The assistant again holds the wound closed by pulling up on the untied stitches while they are tied successively from below upward by the surgeon.

Various methods have been proposed of doubly transplanting the cord and moving the external ring laterally. The most reasonable is that of Willys Andrews who advocated sewing the lateral edge of the external oblique fascia under the cord to the anterior surface of the internal oblique fascia and then pulling the medial edge of the external oblique fascia over the cord and suturing it to the anterior surface of the lateral fascial sheet of the external oblique near the inguinal ligament.[32] We rarely find an external oblique fascia lax enough to treat this way. The strength of the external fascia can be used but once and whether placed above or below the cord does not seem important except for the distinct advantage of preserving the obliquity of the canal.

The subcutaneous fascia in this region is usually a distinct layer and is closed with ten or twelve interrupted No. 60 cotton sutures. The skin is closed with a running continuous cotton stitch. Interrupted skin stitches seem to be unnecessarily meticulous. After the dressing is applied the cremaster muscle is splinted with an adhesive plaster "Bellvue Bridge" across the thighs to support the scrotum.

Bed rest of fourteen to twenty-one days is enforced. Turning the patient on the side and leg bending exercises provide the activity necessary to avoid pulmonary and phlebothrombotic complications. Early ambulation is not justified in plastic herniorrhaphy. Sedatives are used freely throughout the bed rest period to obtain rest and cooperation.

CONCLUSIONS

1. Inguinal hernia is one of the unsolved problems of surgery.

2. Failures can be avoided by improving the technical performance of the operation.

3. Sutures without tension, the use of fascial and sliding grafts, and adequate healing-time are principles of plastic surgery particularly applicable to herniorrhaphy.

4. The omentum is a contributory cause of some hernias and should be amputated.

5. Plain white cotton thread is the suture material of choice.

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Direct inguinal hernias are more difficult to retain by a truss or to cure by operation, from the lack of obliquity of the canal, the large size of the orifice and the thinness of the abdominal wall at Hesselbach's triangle.

From "Principles and Practice of Surgery" by W. Wayne Babcock (Lea & Febiger).

TREATMENT OF PULMONARY EMBOLISM*

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PULMONARY embolism has always been one of the most tragic and most unpredictable of postoperative complications. In a recent comprehensive report from the Mayo Clinic[1] covering over 170,000 patients, pulmonary emboli occurred in one out of every 250 surgical cases. In this group the extreme severity of this complication was emphasized by the fact that of the 897 patients who had pulmonary emboli, 343 died. As usual, many of these patients were healthy individuals, considered good risks, who had had elective surgery and in whom such a complication was entirely unforeseen.

In spite of the seriousness of postoperative pulmonary embolus, there has not been a clear understanding of its exact etiology until quite recently. Of course, it has long been recognized that the emboli originate from venous thrombi which break off into the larger vessels and are carried to the lungs through the heart, but there has been considerable confusion as to the exact mechanism and site of the original thrombus formation. It has gradually been established that there are two stages: First, the thrombosis of a peripheral vein, often but not always associated with a variable degree of thrombophlebitis. This thrombosis then extends proximally until it reaches the junction with a larger vein. At this point the second stage starts, namely, the formation proximally in the larger vein of a free propagating thrombus, with its base fixed to the thrombosis in the small vein and its tip floating free in the lumen of the larger vein. It is this propagating thrombus and not the original peripheral thrombus which breaks off and forms the pulmonary embolus. The original thrombus, especially if there is any thrombophlebitis present, is usually firmly fixed to the vein wall and cannot readily break loose. It later may undergo organization and canalization.

In this connection, it is apparent that whereas a completely thrombosed vein, with or without an associated thrombophlebitis, will cause symptoms of venous obstruction peripheral to the thrombosis, the really dangerous lesion, the propagating thrombus, will cause only partial venous obstruction and may give slight, if any, symptoms. It is also obvious that when a propagating thrombus breaks off there is no reason why another thrombus cannot readily reform and break off again, causing another embolus, as is frequently known to occur. Furthermore, it is evident that while a sluggish circulation favors the development of the primary peripheral thrombosis and the secondary propagating thrombus, so an increased venous circulation or violent motion of the vein walls would tend to break off the propagating thrombus.

As attention has become focussed on the propagating or floating thrombus as the cause of pulmonary embolus it has become increasingly apparent that a majority of these thrombi originate in the legs, in the femoral vein or its tributaries. Even in cases in which there has been evidence of local thrombophebitis elsewhere, as for example, cases of pelvic sepsis or appendiceal abscess, postmortem examination has frequently shown that the source of the pulmonary embolus was from a thrombosis in the leg rather than from the area of local sepsis. The actual incidence of venous thrombosis in the leg in patients who have had pulmonary emboli is almost impossible to estimate accurately,

* The patients in the cases reported in this paper were all treated in civilian practice at Newton, Massachusetts, before the author entered the military service.

for in many cases the legs have not been specifically examined for the possibility of venous disturbance, and even when examined the clinical symptoms are often so slight as to make the diagnosis questionable. The accumulating operative and postmortem evidence, however, indicates that a large percentage, if not almost all, pulmonary emboli originate from thrombosis occurring in the femoral venous system.

The treatment of pulmonary embolism has been approached in general from three different angles: First, treatment directed against the emboli themselves after they have lodged in the lungs; secondly, treatment of emboli prophylactically by preventing the formation of the original peripheral thrombosis and the secondary thrombus; thirdly, preventing the secondary, propagating thrombus from breaking off into the general circulation by mechanically occluding the vein proximal to the thrombus.

As far as the first type of treatment goes, that is treatment of emboli after they have lodged in the lung, practically no important progress has been made, with two possible exceptions, namely, the prophylactic use of the sulfonamides to prevent the development of a secondary pneumonia, and the use of papaverine to relieve spasm in the pulmonary arteries (occasionally a life-saving procedure). The dramatic operation advocated by Trendelenburg, in which the embolus is removed from the pulmonary artery in a patient who is at the point of death, has proven impractical under the conditions which prevail in most hospitals in this country.

The methods of prophylactic treatment of emboli aimed at preventing the occurrence of peripheral venous thrombosis, have chiefly been of two types: measures designed to combat sluggish venous circulation postoperatively; and the use of anticoagulants to prevent intravascular clotting. Among the measures advised, and in some few clinics faithfully followed out, for stimulating the peripheral circulation, the most valuable and practical seem to have been the use of compression bandages, various exercises and changes in position designed to minimize obstruction to return venous flow, and the insistence on early and frequent motion of the legs.

The use of heparin, and more recently of dicumarol, to prevent intravascular clotting has been hailed by many as the final solution of the treatment of pulmonary embolism, both before and after peripheral venous thrombosis has occurred. The results so far have been promising. In the few clinics where heparin has been thoroughly used, it has been demonstrated that the use of a carefully controlled continuous heparin drip will, in many cases, prevent venous thrombosis, or at least will prevent the formation of the propagating thrombus. Bauer,[2] for example, reported a group of fifty-three cases of femoral vein thrombosis; twenty-one of these were heparinized for ten days or longer and did not show any increased thrombosis or develop any embolic symptoms; thirty-two received no heparin and of these twenty-four showed extension of the femoral thrombosis and three had massive pulmonary emboli, of which two were fatal. In general, although no deaths from pulmonary embolism have been believed to occur during adequate heparinization, emboli and occasional fatalities have occurred in patients treated with heparin after heparinization was stopped. This was presumably due to the formation of a propagating thrombus after the influence of the heparin had been removed. There are also other drawbacks to the use of heparin. It is of very little use, as Bauer points out, once the propagating thrombus is fully developed. Moreover, its wholesale use prophylactically in postoperative cases is for practical purposes out of the question due to the expense of the drug and the technical difficulties of administering it continuously, in adequate dosage, while at the same time avoiding overdosage with its danger of serious hemorrhage. These difficulties have also prevented its use in

the average hospital, many of which do not have the facilities necessary to maintain adequate heparin technic.

The discovery of dicumarol, which is inexpensive and can be administered orally, has overcome some of these objections to the wholesale use of an anti-coagulant drug prophylactically. In 497 surgical cases recently reported from the Mayo Clinic[3] in which dicumarol was given prophylactically, the results were extremely encouraging; ninety-one cases of postoperative pulmonary embolism or infarction were treated with dicumarol with no fatalities and only two recurrent emboli, (in both of which cases the ideal prothrombin level had not been obtained with the drug treatment). Sixty-four patients with postoperative thrombophlebitis were similarly treated with no fatalities and only two subsequent emboli; 302 surgical patients with no complications were treated postoperatively with dicumarol without encountering any instances of thrombophlebitis or pulmonary embolism. The difficulties encountered were chiefly in administering the dose of the drug so that an adequate elevation of prothrombin time was obtained without at the same time causing spontaneous bleeding. Spontaneous bleeding in this series occurred in forty-seven patients (10 per cent) and was classified as of moderate to severe degree in eighteen, with one fatality from intestinal hemorrhage. In a few cases[20] it was not possible to obtain a satisfactory anticoagulant effect with what was considered a safe dosage. In spite of its promising action, therefore, the use of dicumarol is still associated with enough difficulties and dangers to lead the average surgeon to use it cautiously and in selected cases.

The last method of treating pulmonary emboli, namely, preventing a propagating thrombus which has already formed from breaking off into the general circulation by occluding the vein proximally, is the method which up to the moment has appealed to us as the most practical life-saving procedure, because of its simplicity, its safety, and the possibility of offering immediately to the patient and his family positive assurance against recurrence or fatality. The operative procedure involved is of such a minor nature that it can be done safely even with critically ill patients. Local anesthesia is entirely satisfactory. The usual technic is simple (assuming always an adequate knowledge of the regional anatomy): Locate the involved vein, open it, remove enough of the thrombus to establish how far it extends proximally (it is not necessary to remove all the thrombus), and finally, ligate the vein proximally close to its junction with the next larger vein. Provided the ligation is close to the junction, any small floating thrombus which might form proximally to the site of ligation would be promptly carried away by the swift flow of blood in the larger vein (usually a vein of the size of the iliac or larger) before it could grow to any dangerous size.

This procedure has usually been applied to the femoral vein, because as noted above it is in this vein that most postoperative propagating thrombi are found to occur. However, occasionally thrombi may be found and removed in other veins, up to and including the vena cava. The technic of approach to the femoral vein need not be described except to mention that it is usually exposed at the upper end from the saphenous junction to below the profunda and that it is well to keep in mind that in this area the femoral vein and artery are enclosed in a common sheath presenting a structure which when first exposed may appear to be the vein (or artery) alone. Care, of course, must be taken not to injure the femoral nerve or its branches. A good description of the procedure in detail has been given by Homans[4] who started advocating femoral ligation for pulmonary embolism in 1934.

The difficulty with this method of treatment is not, however, in the operative procedure, but in the diagnosis. To be most effective it should obviously be applied before the propagating thrombus

has thrown off any emboli and that presents a considerable problem, inasmuch as the majority of propagating thrombi cause slight if any clinical symptoms until emboli are thrown off. Even when the presence of a thrombus is suspected, an accurate diagnosis of its presence, and even more of its location is difficult to make clinically. Although in many cases there may be suggestive signs, such as minor degrees of swelling or soreness of one leg, a positive "Homans sign," or unexplained postoperative fever, these are rarely conclusive, but merely indicate the need of applying some more definite diagnostic test. In the past various complicated diagnostic procedures were suggested, but none were very satisfactory until in 1940 Dougherty and Homans,[4] following the work of Dos Santos,[9] in 1938, reported the use of venography in diagnosing a case of recurrent pulmonary emboli which they found by this method were arising from a thrombus in the left femoral vein. At about the same time Bauer reported his more extensive experience with venography in the diagnosis of femoral thrombi in Sweden. At first it seemed that this procedure completely filled the need for a diagnostic test by which the presence and exact location of femoral thrombi could be shown accurately and in time to be of value, but further experience has shown that not even this diagnostic test is completely satisfactory, although in most cases it is extremely helpful and in some instances conclusively establishes the diagnosis.

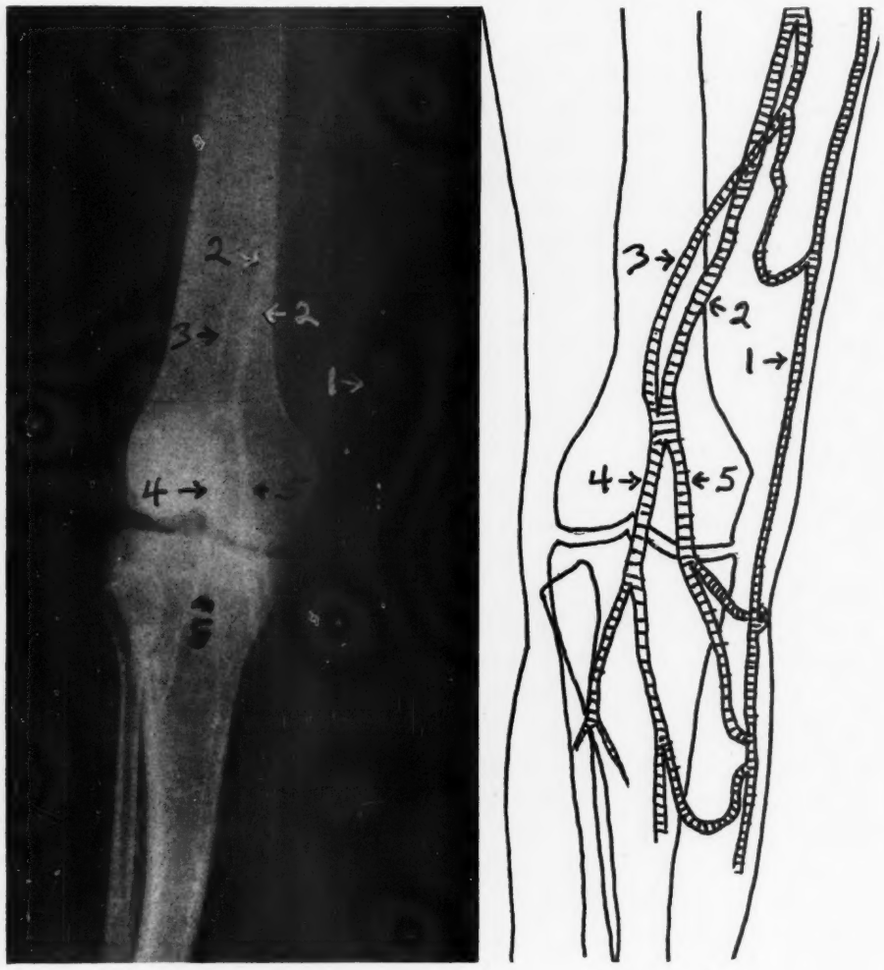
The question may still be raised by some whether femoral ligation should be advised in all cases when the presence of a propagating thrombus has been diagnosed. This question receives some backing from the fact that statistics indicate that only 20 per cent of patients who have had a propagating thrombus (as indicated by their having thrown off a small pulmonary embolus) subsequently succumb to a fatal pulmonary embolism. The argument loses its appeal, however, when the statistics are read the other way and it is noted in the Mayo series, of the 343 patients who died from pulmonary emboli, 33 per cent or 114 were given warning of a fatal embolus by a preceding non-fatal embolus and could have undoubtedly been saved if femoral vein ligation had been done routinely after the first embolus.

The technic and significance of venography has been thoroughly viewed by DeBakey et al. in a recent paper.[8] The exact procedure followed has varied with the individual surgeon and many of the technics reported seem unnecessarily complicated. Homans and Dougherty advise cutting down on the lesser saphenous vein behind the external malleolus and tying in a transfusion cannula. The dye is then injected through the cannula and washed in with a saline infusion. Starr et al.[5] use a similar technic. Linton[6] advises injecting the superficial vein just inside the internal malleolus and uses a blood pressure cuff around the lower leg inflated to a pressure of 20 mm. of mercury, which forces the dye into the deep venous system. Both of these methods give excellent silhouettes of the deep venous system but do not simultaneously fill the superficial system.

The method which we have used with considerable satisfaction is to inject the dye into the superficial vein at the internal malleolus or into one of the other superficial veins of the foot. A size 19 needle is used as in ordinary intravenous injections and usually it is not necessary to cut down on the vein. No pain is caused if novocaine is injected into the skin and if the needle is fully in the vein. A blood pressure cuff is placed around the upper, not the lower leg, as high as possible up into the groin and inflated to 20 mm. of mercury at the time of the injection. By this method the dye is held in both the superficial and deep systems during the *x*-ray exposure, giving a comparative silhouette of both systems simultaneously. We have found that this comparative picture gives additional valuable diagnostic information. In the normal venogram produced by this

method of injection three main venous trunks should be visible in the upper leg—the saphenous medially and the double

determined only by comparing the venogram of the involved vein with a venogram of the same vein on the other (normal) leg.



A B

FIG. 1. A, normal venogram: 1, saphenous vein; 2, femoral vein; 3, profunda vein; 4, popliteal vein; 5, anterior and posterior tibial veins. B, normal venogram: 1, saphenous vein; 2, femoral vein; 3, profunda vein; 4, popliteal vein; 5, anterior and posterior tibial veins.

shadow of femoral and profunda centrally. (Fig. 1.) The absence of one of these shadows is of great importance diagnostically. Similarly in the lower leg the three main systems of internal saphenous, anterior and posterior, tibial should normally be present. It is of great importance to have venograms of both legs done with identical amounts of dye and identical technic, for in some instances when the floating portion of the thrombus only partially obstructs the vein, the vein shadow will not be absent but merely narrowed. Such narrowing can be definitely

This situation applied to two of our cases in both of which the diagnosis of a femoral thrombus was confirmed at operation.

Although we have found venography very valuable, a word of caution must be issued against its wholesale, indiscriminate use. The dyes used are far from innocuous substances if used improperly, as evidenced by the recent reports of occasional fatalities from iodide poisoning following use of intravenous dye in pyelography. It is a wise precaution to test every patient for iodide sensitivity by having them hold a few drops of the solution on their tongue

before using the solution for intravenous injection. A second possible danger is the possibility of the dye itself causing irritation of the vein when it is injected leading to new and extensive thrombosis in previously healthy veins. Rare instances of this complication having occurred have been reported. However, when an increased thrombosis follows an intravenous injection it is difficult to prove that the thrombosis would not have occurred anyway, even if the injection had not been given. In general, although the danger must be kept in mind, it must also be remembered that the dyes used in venography have been used for many years in intravenous pyelography without causing serious vein irritation. Starr,[5] in fact, points out that experimentally the intima of the femoral vein has been exposed to the intravenous dyes used for as long as twenty-four hours "without gross evidence of injury"; and in tests which we conducted we found that all *x*-ray evidence of remaining dye in the veins had vanished within a few minutes after it had been injected.

CASE REPORTS

In the five cases reported below propagating femoral thrombi were accurately diagnosed and successfully treated by using the procedure of venography and femoral ligation during a period of three months from the time our attention was first attracted to these methods of treatment. Further work was cut short by entry into military service. In three of the patients it was not until after the patient had suffered one or more pulmonary emboli that the diagnosis was made, although the diagnosis was suspected earlier in one and not seriously considered because of the minor nature of the symptoms. In the other two cases the diagnosis was made before there was any evidence of pulmonary embolism and prophylactic femoral vein exploration was performed with removal of a femoral thrombus.

Case 1. Mrs. E. J., age sixty-four, was admitted to the Newton Hospital, December 29, 1941, for treatment of a compression fracture of the second lumbar vertebra sustained two days previously when she had fallen backwards into a bath tub. There was no evidence of injury to the legs and practically no external evidence of trauma. The patient was placed on a hyperextension frame for five days. A posterior plaster shell was then applied from hips to shoulders, and anchored in place with circular plaster bandages across the pelvis and chest. The entire abdomen was left exposed because of a tremendous ventral hernia but the cast was steadied by placing a bed pillow in the abdominal opening with a scultetus abdominal binder going around the cast and the pillow. This apparatus immobilized the spine satisfactorily and allowed the patient to turn freely in bed and exercise her legs.

The patient's hospital progress was uneventful until January 19th, sixteen days after application of the cast when she complained of pain in the left upper quadrant. Her temperature rose to 100.4°F. for a few hours and then continued normal. There was no change in pulse or respirations. The white count rose to 13,900 with a normal differential. The pain was not very severe requiring no medication and there was no cough. At the time the probability of a small pulmonary embolus was not suspected.

Ten days later the patient complained of similar pain in her right quadrant. In a few hours this became increasingly severe and localized in the right lower chest. Her temperature rose to 102°F., pulse to 100, respirations to 30. The patient began to cough and raised bloody sputum. The white count rose to 19,000 with a differential of 23 unsegmented polys, 66 segmented polys, 10 lymphocytes and 1 monocyte. The patient had had a slight cold and a diagnosis of pneumonia was made which was confirmed when an *x*-ray showed diffuse, consolidation of the entire right lower lobe. The sputum, however, showed very few pneumococci.

In accordance with the diagnosis of pneumonia the patient was placed on full doses of sulfadiazine but in spite of a blood level of 12.2 mg. per cent, the temperature, pulse, and respirations remained unchanged for five days and the cough and bloody sputum were unchanged. When the pain in the right chest, occasional bloody sputum and low grade temperature continued for ten more days we were

convinced that we had been dealing with a septic pulmonary embolus rather than a true pneumonia. The difficulty was that there was no obvious source for an embolism.

On February 16th, three weeks after this episode the body cast was removed and the patient was allowed to move more freely in bed. Five days later, she suddenly had a severe pain in her left chest with acute dyspnea. Her pulse rose to 160, respirations to 45. There could be no doubt about the diagnosis of a typical severe pulmonary embolus. As is com-

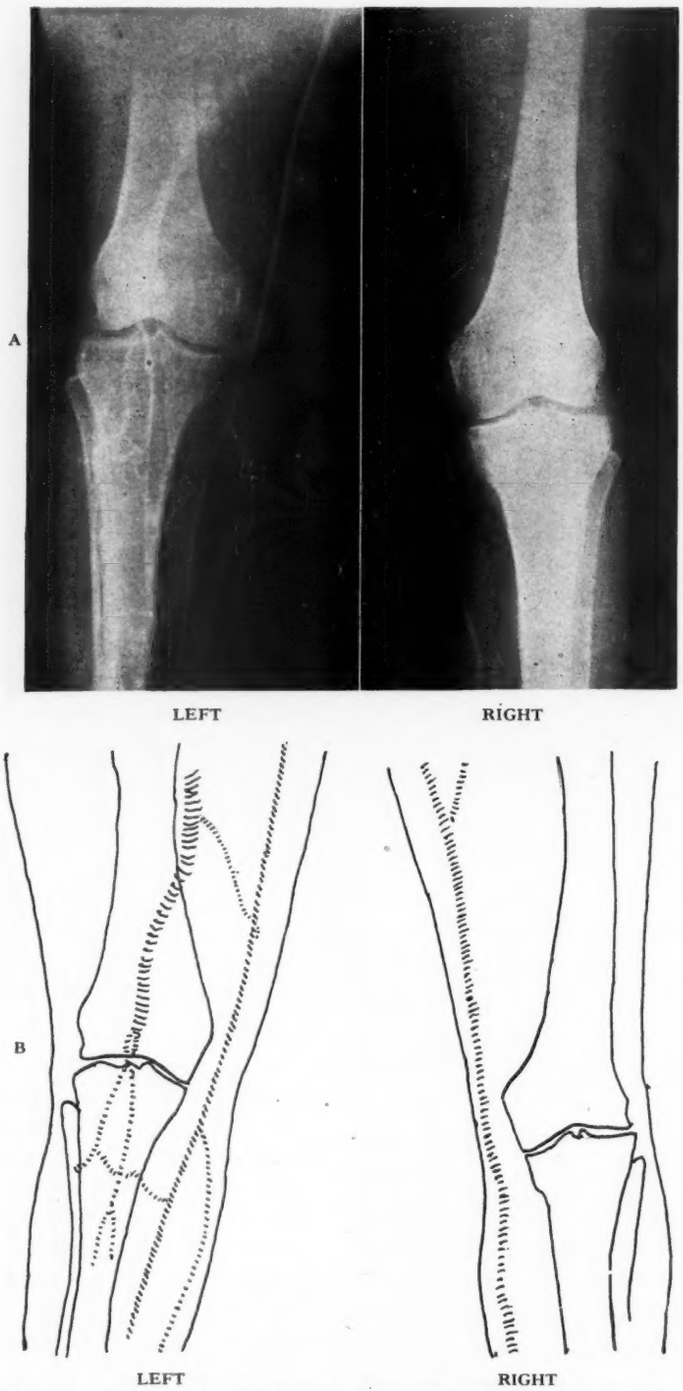


FIG. 2. A. Case 1. Mrs. E. J. *Left*, venogram of right leg, normal; *right*, venogram of left leg; saphenous vein only filled. B, Case 1. *Left*, venogram of right leg, normal; *right*, venogram of left leg; saphenous vein only filled.

mon in acute embolus, *x*-ray did not immediately demonstrate the infarct in the left lung although it outlined clearly the residual healing infarct in the right lung. An *x*-ray taken one week later clearly showed the new infarct. Again the patient's legs were carefully examined but showed absolutely no edema or tenderness. However, on questioning a story was elicited of several transitory attacks of fever, redness and swelling of the left leg occuring at intervals during the past ten years, suggesting a recurrent phlebitis of the left leg. With this lead, bilateral venograms were immediately done, injecting 20 cc. of diodrast in the dorsal veins of each foot. A complete block of the left popliteal and femoral vein was clearly demonstrated while at the same time control venograms of the right leg showed good filling of the femoral and saphenous systems. (Fig. 2.) The left saphenous vein was shown to be patent. On this basis ligation of the left femoral vein below its juncture with the saphenous was advised. A few hours later the left femoral vein was explored through a vertical incision extending for 3 inches distal to the saphenous opening. Local anesthesia was used. On opening the vein it was found to be completely occluded by a soft clot. There was little evidence of inflammation of the vein wall. The thrombus was removed proximally up to the saphenous juncture where free circulation was demonstrated. The femoral vein was then ligated close to the saphenous and a short segment of the vein excised. This segment together with part of the thrombus was saved for examination.

The report of the pathological examination of these specimens was as follows: "Specimen (1) consists of 4 to 5 mm. segment of femoral vein which has a thin wall. The lumen is empty. (2) A small irregular fragment of reddish and pinkish gray thrombotic matter which appears to have come from the vein and measures 0.8 mm. long and 0.6 cm. in diameter. Microscopical examination of section through the femoral vein shows slight irregular thickening of the wall. There is a small patchy lymphocytic infiltration present. Section through the thrombotic matter shows it to be of variegated type.

"Diagnosis: (1) Segment femoral vein. Slight chronic phlebitis. (2) Variegated thrombus." (Such loose thrombi in veins showing little evidence of phlebitis are typical of the condition found in propagating thrombi.)

Following this procedure the patient developed slight edema of the left leg which cleared up completely in four weeks. The most recent pulmonary infarct in the left chest cleared slowly and for this reason the patient was not allowed out of bed until three weeks after the ligation. She was discharged to a nursing home three days later. At the last examination, six months after the operation she had returned to her home in Connecticut and was living a normal life with no discomfort or edema in either leg.

Case II. Mr. P. Z., age fifty-eight was admitted to the Newton Hospital, February 7, 1942, for treatment of swelling and redness of the right lower leg. Two weeks previously he had slipped and fallen on the stairs while working. At this time he felt a pain in his right calf. Two days later his foot began to swell and then the entire lower leg became markedly reddened and swollen to the knee. He had no chills or fever and little discomfort. The swelling and redness improved with ten days' rest and elevation at home but as soon as he tried walking again the foot became swollen and was cyanotic when kept dependent for any length of time. He was sent into the hospital for paravertebral block with a diagnosis of traumatic thrombophlebitis, right popliteal vein.

On admission to the hospital his general examination was essentially normal, blood pressure 120/75, urine and blood studies were normal. Local examination showed the right lower leg reddened, tense and swollen with slight tenderness over the calf only. The superficial veins below the knee were obviously dilated in comparison with the left leg.

Twelve hours after admission to the hospital, before any treatment had been given, he awoke in the night with severe pain in the left chest and acute dyspnea. His pulse was 120, respirations labored. The attack subsided in two hours and the patient felt well the next morning, but showed a few râles at the left base which had not been there twenty-four hours before. Immediate *x*-ray showed no consolidation, but a later *x*-ray showed a healing infarct at the left base. (The lung changes, which follow an embolus and produce an infarct do not develop fully for several hours or days and obviously *x*-ray changes are not demonstrable for a similar period of time.) Electrocardiographic studies were essentially

negative, showing slight left ventricular preponderance but no evidence suggestive of coronary disease or a large pulmonary embolus.

Although it was believed definitely that this patient had had a small pulmonary embolus our first reaction was to follow the old laissez-faire school and take our chances on the future. Local treatment—bed rest, heat and elevation—was supplemented with two paravertebral sympathetic blocks but after two weeks the right leg still became swollen and cyanotic whenever it was hung down for even a few minutes, and the dilatation of the superficial veins persisted even with the leg in bed. This seemed to indicate a fairly extensive thrombosis of the deep venous system probably extending up the femoral vein to the saphenous. At this time, therefore, it was decided to explore and ligate the femoral vein for the dual purpose of preventing further pulmonary emboli and restoring normal circulation to the lower leg (which would be accomplished by interruption of the sympathetic innervation of the femoral vein attendant upon ligation and excision of a segment of the vein).

On February 21st, two weeks after admission, operation was performed, exposing the right femoral vein for a distance of three inches below its junction with the saphenous vein. A vertical incision was used. A firm partially organized thrombus was found filling the femoral vein up to but not beyond the profunda branch. Normal circulation was demonstrated in the profunda and saphenous veins. The thrombus was removed proximally up to the junction with the profunda vein and the femoral vein was then ligated just below its junction with the profunda. A half inch segment of femoral vein showing considerable evidence of periphlebitis was removed. (It was this periphlebitis, of course, rather than the thrombus inside the vein which was responsible for the edema, etc., of the lower leg, for as noted above the thrombus alone may be present without causing any definite peripheral edema.)

Following this operation the redness and edema in the lower leg rapidly subsided. A venogram was done ten days postoperatively and showed good compensatory circulation through the saphenous vein. Two weeks after operation the patient was walking about freely with absolutely no edema or cyanosis and went home one week later ready to return to work. The prompt relief of the edema and cyanosis was particularily striking since this patient had had four weeks of conservative treatment in bed before femoral ligation without relief of the edema.

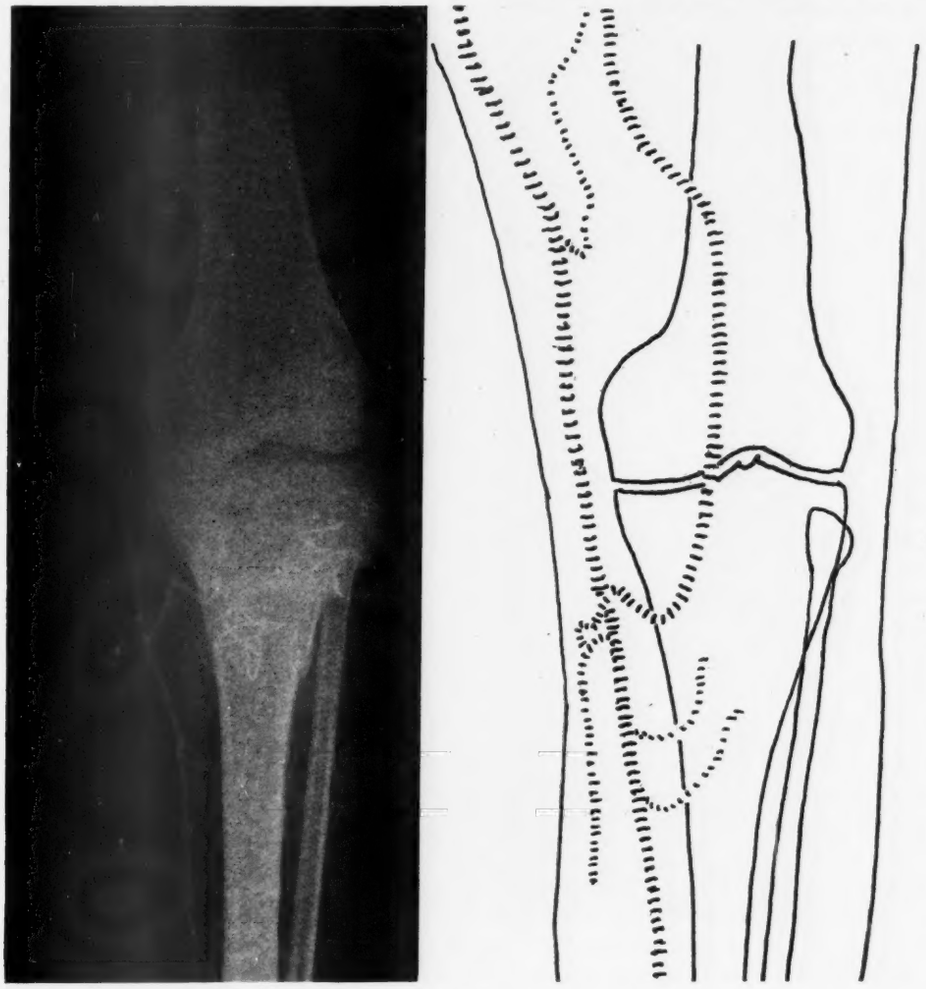
Case III. Mrs. E. D., age fifty-seven, was admitted to the Newton Hospital April 1, 1942, for treatment of an acute pulmonary embolus in the left lung. On December 30, 1941, three months previously, she had been hit by an automobile sustaining a compound, badly comminuted fracture of the left tibia and fibula with destruction of both lower tables of the knee joint. There was extensive subcutaneous tissue damage with considerable trauma to the veins of the anterior and medial aspects of the lower leg in the region just below the knee. An open reduction was performed with satisfactory re-approximation and wiring of the comminuted fragments of the knee joint. A circular plaster cast was then applied extending up to the upper thigh.

There was no infection of the wound and the patient ran a smooth course following the operation except for a low grade temperature just over 99°F. which persisted for over two weeks. Also, on the tenth postoperative day the patient suddenly developed slight swelling of her thigh inside the cast, so that her cast suddenly felt tight. The wound was entirely clean and there was no evidence of deep infection such as swollen inguinal nodes. The possibility that the swelling might have been caused by a mild thrombophlebitis of the popliteal and femoral veins was considered, but the swelling subsided in a few days and it was believed that no further treatment was indicated. The question of doing a prophylactic ligation of the femoral vein to guard against the danger of a pulmonary embolus was raised, but because of the minor nature of the patient's symptoms it was voted down. When two and a half months later the patient left the hospital walking on crutches the incident had been practically forgotten.

When the patient got home she began to receive more vigorous physiotherapy than she had been getting in the hospital. After a few days she complained that this caused some soreness in her knee and lower leg so that orders were given to have it administered less violently. On this régime the soreness subsided and the patient began to walk with a brace without her crutches. Then suddenly one night ten days after leaving the hospital and three months after her operation, she awoke with severe pain in the left chest, cough and acute

dyspnea—the typical picture of a pulmonary embolus.

On admission to the hospital the patient was critically ill and for the first twenty-four hours



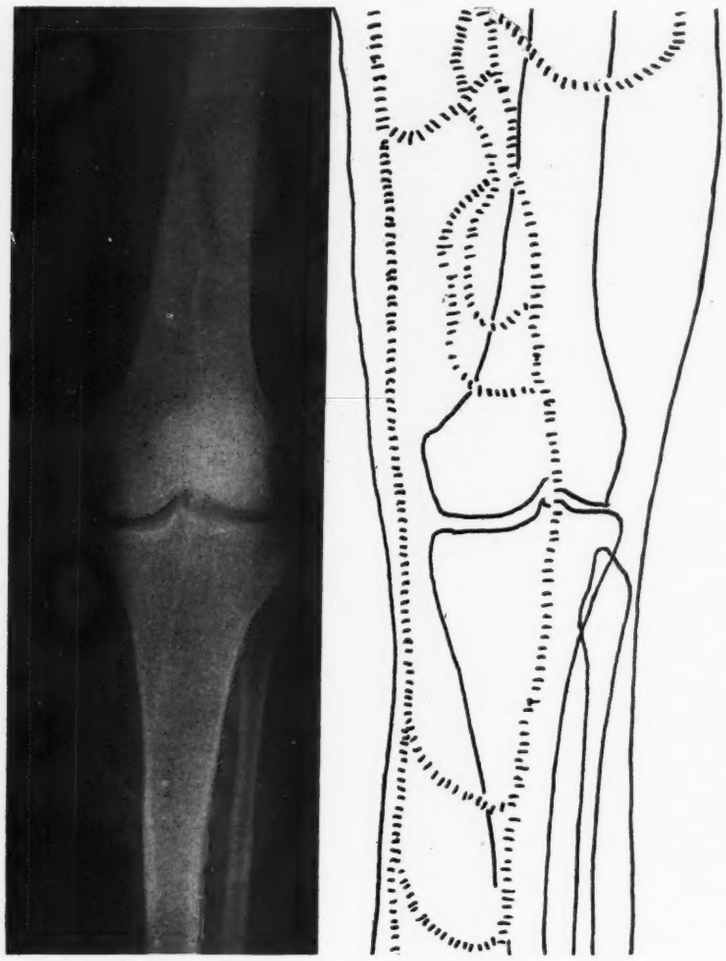
A B

Fig. 3. Case III. A, venogram of left leg; popliteal and anterior tibial veins not filled. B, venogram of left leg; popliteal and anterior tibial veins not filled.

was placed in an oxygen tent. The temperature rose to 103.4°F. in twenty-four hours but further sepsis was controlled by the use of full doses of sulfadiazine orally. *X*-ray studies twenty-four hours after admission and at later dates confirmed the presence of a large area of pulmonary infarction in the lower left lung. On the basis of the history it was believed certain that the origin of the embolus was a propagating thrombus of the left femoral vein probably originating from a traumatic thrombophlebitis of the anterior tibial venous system. Bilateral venograms were done which confirmed this diagnosis by demonstrating lack of filling of the left anterior tibial system. (Fig. 3.) The control venogram showed normal filling of the right anterior tibial system. The left femoral vein did not fill in the venogram. The left profunda and the left saphenous were larger than normal, a situation which had been noted in a previous case (Case IV reported below) in which a propagating thrombus had been removed from the femoral vein.

Because of the patient's critical condition exploration of the left femoral vein was postponed for three days. On April 4th, however, the left femoral vein was exposed under local anesthesia through the usual vertical incision. On opening the vein close to its juncture with the saphenous no thrombus was found but it was demonstrated that while there was a free retrograde flow of blood from the iliac vein back into the femoral there was no flow of blood from below, indicating a complete block of the lower end of the femoral system. It was believed that originally the propagating thrombus had probably occupied the entire femoral vein but that the portion occupying the upper

femoral had broken off to produce the recent embolus and had not yet reformed. Further exploration was not done but the femoral vein was ligated just below the profunda, removing a small half inch segment of the vein. (In performing this operation we remove a segment of the vein routinely, believing that such removal with its interruption of sympathetic fibers relieves the edema of peripheral thrombophlebitis, and will also act as insurance against the formation of edema which might result from periphlebitis following exploration of the femoral vein. In this case there was some edema of the foot present before operation and this had almost entirely disappeared within the next two weeks.)



A B

Fig. 4. Case iv. A, venogram shows single narrow trunk instead of broad double shadow of femoral and profunda veins normally seen. B, venogram shows single narrow trunk instead of broad double shadow of femoral and profunda veins normally seen. Note abnormal collateral veins.

Because of the large pulmonary infarct this patient was not allowed out of bed for two weeks after the operation. One week later she was sent home walking (with crutches) and with less edema of her foot than she had had at any time since she had been out of bed after her accident. During the subsequent five months the patient continued in good health and gradually regained good function of her knee, although the enforced bed rest necessitated by the pulmonary infarction slowed up the motion of her knee considerably. In this connection it is interesting to speculate how much better off the patient would have been in every respect if prophylactic femoral ligation had been done when it was first considered at the time when the patient first showed suggestive signs of femoral thrombosis, ten days after her injury.

Case iv. Mrs. E. M., age fifty-two, was admitted to the Newton Hospital, February 17 1942, for repair of a huge ventral hernia in an

old cholecystectomy scar. In her past history she had had four laparotomies, two of which were cesareans, one appendectomy and finally the cholecystectomy, done ten years ago. She had noticed varicose veins in both legs but never had a milk leg or any symptoms suggestive of phlebitis. Physical examination on admission was negative except for the large ventral hernia, marked general obesity, and moderate varicose veins of both legs.

On February 19th, under spinal anesthesia the ventral hernia was repaired. Because of the large size of the hernia defect and the difficulty in approximation, a tight scultetus binder was ordered and kept tightly in place for three weeks.

Postoperatively the patient ran a febrile course with temperature between 100 and 101°F. daily. This was accounted for by a cystitis which developed from an inlying catheter and from a stitch abscess. The stitch abscess drained on the tenth day but continued to discharge pus for two weeks.

On March 5th, on her fourteenth postoperative day, she suddenly complained of pain in her left calf. There was very slight tenderness of the calf with a positive Homan's sign but no edema or redness and no increased fever or chills. Bilateral venograms were immediately done using 10 cc. of diodrast in each leg. The left popliteal vein did not fill and the left femoral was narrowed while the left saphenous was larger than normal. (Fig. 4.) This indicated to us a thrombophlebitis of the left popliteal vein with a propagating thrombus in the left femoral vein.

With this definite evidence of thrombosis in the leg it was decided to do an immediate prophylactic ligation of the left femoral vein. Approximately twelve hours after the onset of the leg pain the left femoral vein was explored through a vertical incision extending 3 inches distally from the saphenous opening. The vein was opened and the venous flow from below found to be completely obstructed. There was a considerable amount of soft clot which was removed with suction. The absence of periphlebitis and the presence of a soft thrombus which was attached to the vein wall confirmed the preoperative diagnosis of propagating thrombus of the femoral vein. A half-inch segment of the vein with attached clot was excised and the ends of the vein ligated.

The pathological report of the specimen of vein and thrombus removed was as follows; "Specimen consists of a short resected segment of vein 0.7 cm. long and 0.5 cm. in diameter. The lumen is occluded by thrombotic material. Microscopical examination of section through the segment of femoral vein shows the lumen to be occluded by variegated thrombotic material. The wall presents moderate irregular fibrous internal thickening and shows a light diffuse infiltration of lymphocytes and a few neutrophils.

"Diagnosis: Femoral vein. Thrombophlebitis."

Following the operation there was slight edema of the lower leg for ten days. Most of this edema seemed to be centered over an area on the dorsum of the foot where a small amount of diodrast had been injected outside the vein and it was believed that the edema was probably due to this rather than to the ligation of the femoral vein. The patient was allowed out of bed on the eleventh day after ligation and went home one week later. The edema of the leg had almost disappeared except for the local area on the dorsum of the foot when she left the hospital and had entirely cleared up one month later.

Case v. Mr. W. H., age sixty-eight, was admitted to the Waltham Hospital, March 8, 1942, with a general peritonitis due to a ruptured appendix of several hours' duration. His past history was negative except for a bilateral hernia repair twenty years ago.

Shortly after admission appendectomy with drainage was performed and 12 Gm. of sulfanilamide crystals introduced into the peritoneum. Sulfadiazine was given by mouth in full doses for the next two weeks. He had a very stormy postoperative course marked by almost continual delirium, recurrent vomiting and several episodes of bleeding from his wound, culminating in complete evisceration of the incision on the twenty-second postoperative day. This was resutured. Following resuture (and the omission of the sulfadiazine) he ran a smooth postoperative course and was up and walking ten days after this secondary operation. Five days later he suddenly noticed that his right ankle and leg became swollen and cyanotic when he put his legs down. A clinical diagnosis of probable thrombosis of the right femoral vein was made with a possibility (in view of his recent pelvic sepsis) that the thrombus might extend even higher into the right iliac vessels. A bilateral venogram was done and settled the diagnosis definitely by revealing

a complete block of the right femoral vein with a patent right saphenous vein (indicating that the block did not extend above the junction of the saphenous with the femoral vein).

With this definite diagnosis and in view of the patient's postoperative course it was believed that this patient had a better than average chance of developing a pulmonary embolus. Accordingly exploration of the right femoral vein was advised. On April 18th, under novocaine anesthesia the upper end of the vein was exposed through the usual vertical incision. The vein was opened and found to be occluded up to but not beyond the saphenous opening by a firm organized thrombus lightly attached to the vein wall. After this thrombus was removed the iliac vein was thoroughly suctioned and no further clot found. The femoral vein was then ligated just distal to the saphenous vein and a half inch segment of the vein excised. The specimens were sent to the pathologist for examination and the report returned, "Organizing thrombus of femoral vein with slight thrombophlebitis of vein wall."

Following this femoral ligation the patient made an excellent recovery. He was allowed out of bed two days after the operation and sent home walking freely and with no edema of his foot seven days later.

In this case, as in Case IV, femoral exploration and removal of the threatening thrombus was done entirely prophylactically as soon as the diagnosis was made and before the patient had a chance to develop a pulmonary embolus. In neither case was the patient bothered by the procedure and the hospital stay was shortened rather than lengthened due to the prompt control of the thrombophlebitic edema which followed the partial resection of the upper femoral vein.

COMMENT

In reviewing our experience with these five cases certain features attracted our particular interest:

First, the diagnosis of femoral vein thrombosis when it is not associated with obvious thrombophlebitis—and the cases not associated with obvious thrombophlebitis are certainly the most dangerous from the point of view of pulmonary embolism—is often difficult to make because of the minor character of the clinical symptoms. If the possibility is kept in mind, however, the diagnosis can often be suspected and the suspicion verified by the use of venography. Positive treatment can then be instituted before a possible fatal pulmonary embolus occurs. In this connection it is worth noting that in one of our cases in which the diagnosis was suspected no further procedures were carried out because of the minor nature of the symptoms with the result that this patient suffered an almost fatal embolus at a later date (at which time the diagnosis of femoral thrombosis was made and femoral ligation and resection successfully performed). In cases in which a pulmonary embolus already has occurred and there is a good chance of another embolus occurring, evidence of femoral vein thrombosis should be carefully looked for and even if no evidence is found venography should be done. In one of our patients there were absolutely no clinical signs suggesting any trouble with the femoral vein or its tributaries but a thrombus was located by venography and later removed at operation.

Secondly, the question of the relationship of edema of the leg to femoral vein thrombosis interested us especially. In these few cases it was quite evident that marked edema was present only when there was definite thrombophlebitis in the peripheral veins and was very slight or absent when there was a bland femoral thrombosis, even though the femoral vein was completely obstructed up to the saphenous junction. Postoperatively, there was slight edema of the lower leg for a few days in four of the five patients and in all of them this was associated with signs of some mild thrombophlebitis, as evidenced particularly by some tenderness along the femoral vein. Interestingly enough, in the one case in which marked thrombo- and periphlebitis was found at operation the edema disappeared entirely a few days after femoral ligation and partial resection. This probably was due to the interruption of the perivascular sympathetic nerve fibers produced by the resection of the femoral vein. It is evident, therefore, that

simple obstruction of the femoral vein does not produce edema; and if the saphenous or other collateral systems are patent, femoral ligation should not by itself cause edema. Furthermore we suspect that by resecting a small portion of the femoral vein at the time that we do a femoral ligation the probability of postoperative edema of the lower leg is greatly decreased in the same manner that thrombophlebitic edema is relieved. In fact, if Ochsner and DeBakey's theory of thrombophlebitis[7] is correct, interruption of the perifemoral sympathetic chain should be good insurance against the postoperative development of a peripheral thrombophlebitis, which as we have noted above is the chief cause of edema in these cases of venous thrombosis. However, our group of cases is too small to permit drawing any definite conclusion on this point.

A third feature of interest to us in these cases, particularly in the patients who had already suffered a pulmonary embolus, was the tremendous satisfaction we derived from being able to offer these patients a positive, rational form of treatment instead of having to offer them and their families weeks of anxiety and danger with the possibility of sudden violent death threatening. The peace of mind obtained, in addition to the satisfying clinical results, was certainly worth the slight dangers offered by venography or the minor local operation. The contrast between the old and the new method of treatment is brought home forcibly when a patient who has had a near fatal pulmonary embolus is able to leave the hospital walking two weeks later instead of spending anxious weeks in bed and not even being sure then that another embolus may not occur.

SUMMARY

1. The etiology and present methods of treatment of pulmonary emboli are reviewed, emphasizing the fact that most emboli are believed to originate from free propagating thrombi in the femoral venous system.

2. The use of femoral vein ligation in the prophylactic treatment of pulmonary embolism and the use of venography in the diagnosis and localization of femoral thrombi are discussed and evaluated.

3. Five cases are reported in which accurate diagnosis of femoral vein thrombi was made largely through the use of venography and in which satisfactory results were obtained by ligating and partially resecting the involved femoral vein. Three of the patients had suffered pulmonary emboli before the femoral vein ligation was performed.

4. In addition to the removal of danger of further pulmonary emboli, the operation of ligation and partial resection of the femoral vein was observed to have a beneficial effect on associated thrombophlebitis when this was present, particularly in the prevention as well as relief of associated peripheral edema.

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THE RELATIVE EFFICACY OF PENICILLIN, TYROTHRICIN, STREPTOTHRICIN AND SULFATHIAZOLE ON HEMOLYTIC STREPTOCOCCUS IN WOUNDS OF RABBITS*

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THE wave of enthusiasm concerning the usefulness of sulfonamides in the treatment of localized infections has subsided, since it is realized now that these drugs have but a limited therapeutic value and little effect upon micro-organisms in wounds and other localized infections. Interest, therefore, has been focused on anti-biotic substances. The most promising of them are penicillin, streptothricin and tyrothricin. Favorable reports on the effects of locally applied penicillin have been published, among others, by Flory and Flory,[1] as well as by Sophian[2] and Peck.[3] Tyrothricin, which exerts marked anti-microbial activity both *in vitro* and *in vivo*, has been employed as a therapeutic agent in localized infections of man by Rammelkamp,[4] Herrell and Brown[5] and in animals by Bryan, Weldy and Greenberg,[6] Bean, Miller and Heishman,[7] and others. Very recently, Waksman and associates,[8] Robinson,[9,10] as well as Metzger, Waksman and Pugh[11] have studied the effects of streptothricin and obtained very encouraging results both in *in vitro* tests as well as in animal experiments. In order to ascertain the relative efficacy of these compounds, experiments were carried out to determine by comparative studies their action upon group A beta hemolytic streptococcus in artificial wounds of rabbits.

MATERIALS AND METHODS

Rabbits weighing between 2,200 Gm. and 3,500 Gm. were used in this investigation. Artificial wounds were produced as described previously.[12] The wounds were infected with an eighteen-hour infusion broth culture of a strongly fibrinolytic group A beta hemolytic streptococcus, isolated from a human source. The strain was susceptible *in vitro* to the action of the anti-microbial agents used in this study. Powder of sulfathiazole, tyrothricin and streptothricin was applied to the entire area of the wound and evenly distributed. When amounts smaller than 10 mg. were used, the drug was mixed with calcium carbonate and disodium phosphate and the total weight brought up to 10 mg. In some experiments a watery suspension of tyrothricin was also employed. Penicillin was used in amounts of 0.05 ml; the sodium salt was dissolved in appropriate amounts of sterile distilled water. It was found that 0.05 ml could be applied to the wound without appreciable loss. After a period of twenty-four hours the drugs were removed from the wounds with a swab. This procedure was adapted after it was found that this manipulation did not result in the elimination of the streptococci present in the wound itself. Material from the wounds was taken with a swab and seeded on 5 per cent human blood agar in Petri dishes. Cultures from the wounds were taken in duplicate. The blood agar plates were incubated at 37°C. for seventy-two hours and the approximate number of hemolytic streptococci was recorded.

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RESULTS

The findings in thirty experiments, involving 181 artificial wounds in rabbits infected with beta hemolytic streptococcus and treated with sulfathiazole and various anti-biotics, are summarized in Table 1.

TABLE 1
COMPOSITE RESULTS OF 30 EXPERIMENTS ON RELATIVE EFFICACY OF ANTIBIOTICS AND SULFATHIAZOLE ON HEMOLYTIC STREPTOCOCCUS IN WOUNDS OF RABBITS

	No. of hemolytic streptococci in wounds after treatment for 24 hours			
	Many	Moderate No.	Rare	None
Treatment	No. of experiments			
Sulfathiazole, 100 mg.	15	1	0	0
Tryothricin, 25 mg.	0	5	0	1
10 mg.	1	8	1	0
1 mg.	5	4	0	0
Streptothricin, 100 mg.	0	4	3	0
25 mg.	0	5	2	1
10 mg.	0	7	1	1
1 mg.	4	5	0	0
Penicillin 5,000U.	0	3	3	7
250–500 U.	5	11	8	4
25–100 U.	11	8	3	2
2.5–5 U.	11	1	0	0
None (control)	30	0	0	0

It may be seen from this table that many hemolytic streptococci were present without exception in all of the thirty untreated wounds. Application of 100 mg. of sulfathiazole to infected wounds resulted in the reduction in the number of hemolytic streptococci in only one out of sixteen experiments. This observation of the ineffectiveness of sulfathiazole under the conditions of these experiments confirms previous findings with sulfanilamide.[12] In contrast to sulfathiazole, three anti-biotic substances, namely, tyrothricin, streptothricin and penicillin, were found to be effective under the same experimental conditions. It may be seen from the table that 25 mg. of thyrothricin caused a reduction in the number of hemolytic streptococci in all of six experiments and 10 mg. of tyrothricin in nine out of ten experiments. It is also evident that smaller amounts (1 mg.) of this therapeutic agent are less effective than larger quantities (10 and 25 mg.). It is interesting to note that 1 mg. of tyrothricin produced a reduction in the number of streptococci in four out of nine experiments and thus proved to be somewhat more efficacious than 100 mg. of sulfathiazole. Hence, tyrothricin under the conditions of this experiment proved to be at least 100 times more effective than sulfathiazole.

Streptothricin, too, exhibited anti-streptococcal activity in these experiments. It may be seen from Table 1 that this compound in amounts of 1 mg. to 100 mg. caused a reduction in the number of streptococci in twenty-nine out of thirty-three experiments. In all of twenty-four experiments 10 mg. of streptothricin or more was effective. Like tyrothricin, streptothricin proved to be at least 100 times more efficacious than sulfathiazole.

The study of the anti-streptococcal activity of sodium penicillin upon hemolytic streptococcus in artificial wounds of rabbits revealed the following: Penicillin in amounts of 2.5 to 5 units had no effect in eleven out of twelve experiments. Somewhat larger amounts, namely 25 to 100 units caused a reduction in the number of hemolytic streptococci in thirteen out of twenty-four experiments, in amounts of 250 to 500 units in twenty-three out of twenty-eight experiments and in amounts of 5,000 units in all of thirteen experiments. It is evident, therefore, that 25 to 100 units of penicillin exerted greater anti-streptococcal activity than 100 mg. of sulfathiazole. Compared with streptothricin and tyrothricin, 2 to 5 units of penicillin yielded somewhat poorer results than 1 mg. of the former substances.

COMMENTS

Well known is the fact that the *in vivo* activity of disinfectants, chemotherapeutic

substances and anti-biotics does not always parallel their action *in vivo*. For instance, prontosil is much more efficacious in infections of man and animals than in artificial culture media. On the other hand, it was reported recently that sulfonamides and azochloramid act synergistically *in vitro* and no such effects were demonstrated either in mastitis caused by group C hemolytic streptococcus or in experimental wound infections in rabbits due to group A hemolytic streptococcus.[13,14] Consequently, it is imperative to study any new chemotherapeutic agent both *in vitro* and *in vivo*. The investigation reported here was undertaken to determine the relative efficacy under *in vivo* conditions of sulfathiazole, penicillin, tyrothricin and streptothricin against group A beta hemolytic streptococcus. It was found that the anti-biotics, penicillin, tyrothricin and streptothricin, were considerably more efficacious than sulfathiazole, a widely used representative of the sulfonamides. As a matter of fact, 100 mg. of sulfathiazole applied to the infected wound failed to reduce the number of hemolytic streptococci in fifteen out of sixteen experiments, whereas 1 mg. of streptothricin and tyrothricin caused such a reduction in nine out of fourteen tests. Hence, these anti-biotics proved to be at least 100 times more effective than sulfathiazole. Penicillin, too, exerted considerably greater activity than sulfathiazole under these experimental conditions.

The question may be raised as to whether or not the ineffectiveness of sulfathiazole is due to the fact that treatment was carried out for a period of twenty-four hours only. However, previous experiments revealed that therapy with sulfonamides for forty-eight hours yielded only slightly better results.

Mention must be made of the fact that sulfathiazole, tyrothricin and streptothricin were applied to the wound as powder. Their therapeutic activity depends not only upon their specific anti-streptococcal efficacy, but also upon the degree and rate of dissolution in body fluids, their penetration into the infected tissues, their excretion and possible destruction in the wound itself.

As far as the failure of sulfathiazole to eradicate the hemolytic streptococcus is concerned, the observations reported here confirm previous findings with sulfanilamide.[12,14] It is interesting to note that according to Waud[15] the concentration of sulfathiazole applied locally was found to be much less in the tissues beyond 2 to 3 mm. below the surface of the wound than that ordinarily reached when sulfathiazole is given by mouth. It is desirable to reconsider the indications for the local implantation of sulfonamides in infections of man. From the study reported here it is evident that all anti-biotics tested, namely, penicillin, tyrothricin and streptothricin, proved to be more efficacious than sulfathiazole against the group A beta hemolytic streptococcus in artificial wounds of rabbits.

The toxicity of these agents differs to a considerable extent. Penicillin is considered to be almost non-toxic to human beings. Tyrothricin, on the other hand, has certain toxic properties which restrict its use to local application. Streptothricin, according to Waksman,[8] is characterized by limited toxicity to animals. Further investigations are necessary to determine whether or not this compound produces toxic effects when used therapeutically in human beings.

The spectra of activity of various anti-biotics show marked differences. Penicillin exerts definite anti-bacterial activity toward pneumococcus, streptococcus, staphylococcus, certain Gram-negative cocci (meningococcus and gonococcus), certain Clostridia and several others, but is largely ineffective against the majority of Gram-negative bacilli, including members of the Hemophilus group and the majority of enteric pathogens such as typhoid, paratyphoid and dysentery bacilli. Streptothricin, on the other hand, acts on various Gram-positive and Gram-negative bacteria. It is of particular significance that this compound proved to be effective in animal

experiments in certain paratyphoid and brucella infections. Tyrothricin, a mixture of gramicidin and tyrocidin, exerts its main antimicrobial activity against Gram-positive pathogens.

Of great importance is the stability or the instability of these compounds under conditions of infections. It is well known that penicillin may be rapidly destroyed by certain micro-organisms. Similarly, certain substances found in some Gram-negative micro-organisms are strongly inhibitory to tyrothricin. In contrast, streptothricin, according to Waksman,[8] is stable against destruction by various bacteria tested thus far.

It is evident from the data reviewed here that any of the anti-biotic substances have their limitations and that only by appropriate consideration of the infectious disease and the micro-organisms present as well as of the properties of the various anti-biotics will it be possible to select the best compound for treatment in individual instances. As far as hemolytic streptococcal infections in artificial wounds of rabbits are concerned, it is clear from the observations presented in this report that the anti-biotics penicillin, tyrothricin and streptothricin, are definitely superior to sulfathiazole. Further investigations are necessary to determine the relative efficacy of these compounds against other micro-organisms and to elucidate the question as to whether or not the simultaneous administration of two of these compounds may yield better results.

SUMMARY

1. In artificial wounds of rabbits infected with a strain of group A beta hemolytic streptococcus (susceptible *in vitro* to the action of all anti-microbial agents tested), streptothricin, tyrothricin and penicillin proved to be efficacious in decreasing the number of streptococci.

2. Tyrothricin and streptothricin were more effective than 100 times the amount of sulfathiazole.

3. No significant differences in activity were noted between equal amounts of streptothricin and tyrothricin.

4. Penicillin in amounts of 2.5 to 5 units was ineffective; in larger amounts, ranging from 50 to 5,000 units, this drug reduced the number of hemolytic streptococci in the wounds.

5. The merits and limitations of the various compounds for the treatment of localized infections are discussed.

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USE AND ABUSE OF CESAREAN SECTION*

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NO obstetrician will deny that a suprapubic vagina would have solved his greatest headaches. Surely it seems that nature provided in man a most difficult manner of birth, a paradoxical reward for submitting to the profound biologic urge upon which continuity of the race depends. For parturition is complicated by a birth tract not only bony-walled and curved, but subjected to compromising variations in size and shape. And were this not enough, there are added variants in the adaptation of organs and tissues to the passage of a fetus which itself is no fixed factor.

The first labor is the crucial one for most, since it tests the pelvic capacity as well as the effectiveness of expulsive efforts upon the infant. True it is that hazards exist for subsequent parturitions, but a patient once successfully delivered at term of a normal infant never again presents the same problem. This equanimity of judgment is not always valid, nevertheless it exists. It is a tribute to the fact that the majority of dangers at the time of childbirth are dependent upon feto-pelvic relationship and the successful continuity of the numerous physiologic changes which we encompass in the word "labor."

Countless generations attest that most babies successfully negotiate the normal birth tract. There exists a small percentage in which vaginal delivery is either impossible, or so compromises the safety of one of the principles involved that some *other* means must be taken to terminate the pregnancy or labor. It is with this small percentage, certainly seldom more than five, that the subject of this presentation is concerned.

Cesarean section represents the *alternate* birth tract. Let no one ever believe it is the *best*. In its most successful application it carries a maternal death rate far higher than that noted in statistical compilations of vaginal deliveries. In less competent hands or under less favorable circumstances, the mortality may reach unbelievable figures. Yet when the indication is just and the performance is good, the procedure of cesarean section embodies a far better prospect for the principals than vaginal delivery.

The good use of cesarean section is, therefore, predicated upon careful case selection, since a bad choice of abdominal delivery might not be equalized by a technically satisfactory operation. And if its indications can be detailed with reasonable accuracy and adhered to, with good performance good results may be anticipated. Conversely, misuse of the operation eventually leads to needless disaster.

The *incidence of cesarean section* in most good clinics is not more than 5 per cent. It is conceivable that for small series such a figure may be exceeded or even a very low one achieved. Our own incidence for cesarean section in 68,786 deliveries was 2.67 per cent (1 in 1837 cases). It is fair to warn that an extremely low figure might be achieved and look good if one forgets subsequent repair of birth tract wreckage, or the mentally disabled or dead infants. For consideration of the results of ill-advised operative vaginal delivery is pertinent in any discussion of cesarean section.

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Thus a very low incidence may be too low when the end results of certain vaginal deliveries are seen. But an extremely high percentage of sections in a comprehensive series may indicate a careless handling of material, a casual interest in delivery probabilities or a disregard of recognized obstetric data and procedure.

The most common indication for cesarean section is cephalopelvic disproportion or maladjustment. Careful abdominopelvic examination, clinical and *x*-ray mensuration, and Hillis maneuver at term, generally serve to make those cases of actual disproportion obvious, with early resort to elective section. It is the borderline case which poses the question, often unanswerable until time for elective operation has long since passed. Most misleading is the patient who presents a markedly moulded head often to or below the spines but with non-engagement, in a pelvis of moderately restricted capacity. To section such patients indiscriminately would mean many needless operations, for with time and labor a large proportion deliver. Only the fine art of discrimination based upon years of experience, often bitter, suffices to make the proper decision. For labor efficiency, rapidity of cervical dilatation and effacement, mouldability of fetal head and soft tissue accommodation are factors of importance, immeasurable by any methods we now possess. It is in this type of borderline case that deflection attitudes in the fetus further complicate the delivery problem, and if unrecognized, lead either to a badly traumatizing and dangerous vaginal delivery, or a cesarean section in an infected patient. Rupture of the membranes prior to onset of labor and sluggish intermittent pains are other occurrences which deny these patients elective section. They are properly serviced only by application of extraperitoneal cesarean technics. "Cervical dystocia" with intermittent labor falls into the same group. Our clinic so frequently recognized the fallibility of experienced judgment that the chiefs of service commonly utilize reciprocal consultation before deciding to operate. The incidence of cesarean section for dystocia problems in private cases has been materially reduced by requiring approved consultation in prolonged labor or dystocia cases before operation is considered. It is a safety stratagem which I strongly commend to you for protection of patient, doctor and hospital, one which might well be invoked in all cases everywhere. We have found it of value not only in avoiding needless sections but also in applying the proper abdominal operation when an otherwise sacrificial vaginal delivery had been contemplated.

A full term breech presentation in a primipara is not *per se* an indication for cesarean section. An unengaged breech after adequate pains for several hours may be. Here again the exercise of judgment must balance the hazards to maternal soft parts and fetus of vaginal delivery against a major abdominal operation. In our experience, the incidence of section for breech presentation in primiparae is not much higher than general cesarean section incidence. Other factors rather than the circumstance of breech presentation and adjustment more commonly influence the decision for section. No hard and fast rule can be made for transverse or compound presentations. These commonly occur with small babies or multiple pregnancies and set forth no problem. But a large fetus in neglected labor fixed in transposition may offer no choice other than vaginal operation with risk of uterine rupture or extraperitoneal cesarean section. Because of lower maternal mortality and morbidity and better fetal salvage, the latter procedure is the one of choice.

The three major hemorrhagic complications of the last trimester of pregnancy, abruption of the placenta, placenta previa and rupture of the uterus, produce many cesarean operations. How shall we proceed when faced with these emergencies?

It is fruitless to deny that many premature placental separations in multipara can be managed best by so-called conserv-

ative treatment, with vaginal delivery awaited. A placental abruption in any patient, especially primipara, with active bleeding, exhibition of shock and closed cervix, is best treated by cesarean section, after suitable measures are taken to combat shock and blood loss. In the mild type of abruption almost any form of treatment will give passable results. But our figures for so-called conservative treatment of severe abruption have not been any better than those achieved elsewhere, while the results with cesarean section suitably shielded by active anti-shock therapy are comparatively excellent. The figures I am submitting in the table on placental abruption testify to its worth.

Placenta previa can cause death from hemorrhage more quickly than almost any other condition, although the factor of shock is less notable than in abruption of the placenta. We believe cesarean section is a safer and better way to deliver women with placenta previa than any type of vaginal interference, such as bagging or Braxton-Hicks version. An exception is made in patients who bleed from partial previas only after considerable cervical dilatation is attained, especially in multipara. Here rupture of membranes and presenting part tamponade of the placenta may effectively check the bleeding and permit vaginal delivery. But dilatory management of a bleeding placenta previa with non-dilated cervix, notably primipara with no previous labor experience, denies the patient a decent chance to survive.

Rupture of the uterus obviously requires abdominal section as soon as the diagnosis is made and the patient made operable. The intraligamentous rupture with extraperitoneal bleeding can be diagnosed by vaginal palpation and an extraperitoneal approach made, thereby avoiding peritoneal contamination which so frequently ends with the patient's death. Hysterectomy in this type is unnecessary. With all other forms of rupture, cesarean-hysterectomy must be done and sulfa drugs with other supporting therapy relied upon to check peritonitis.

The toxemias of pregnancy are not indications for cesarean section. Eclampsia almost never is. Antepartum eclampsia when brought under control may be followed by a cesarean if severe toxemia persists or recurs. In primipara, severe preeclampsia not responding to active treatment justifies section. In general, conservative management is applied in patients responding to antitoxic therapy, with section used only when progression of symptoms, especially in primipara, or other associated indications are manifest. Of 1,015 cases of pre-eclampsia in the past four years, thirty-three or 3.2 per cent were subjected to cesarean section. The incidence of toxemia in our clinic has steadily dropped in the past few years, reaching 3 per cent in 1943. It is obvious, therefore, that relatively few of our sections are solely for toxemia of pregnancy.

Since we regard classical section as largely of historic interest and as dubiously justifiable in this age as a blind trochar-ovariotomy, I wish to clarify our position with respect to repeat section. Since our operations, both trans- and extraperitoneal, are all low segment operations, we do not believe that repeat sections are invariably necessary. A large number will be, since disproportion is the most usual initial indication. But when the baby is much smaller, or the first section done for some non-recurrent reason such as placenta previa or toxemia, we permit labor and vaginal delivery in a considerable number. Low vertical incisions are not as safe as transverse, and are regarded with more suspicion. Classical incisions done elsewhere have caused uterine ruptures so often that we never voluntarily allow these patients to labor. The mortality from uterine rupture is so high that elective section should be routinely chosen in such patients previously operated upon in the manner of 1890 to 1920.

Cesarean section is indicated for certain abnormalities, such as bicornuate uterus

and vaginal stenosis, and such pathologic complications as carcinoma of the cervix, obstructing fibroids and pelvic incarceration of ovarian tumors. It may be elected, though not necessary, to save the pelvic structures from repeated trauma after such operations as cervical amputation, Manchester-Fothergill and other vaginal plastics. Careful consideration of existing conditions and competent consultation serve best the patient's need, since each case poses an individual problem. Pooling of experience in the uncommon situation is more imperative then elsewhere, since few possess the background of experience with rarely encountered conditions to give substance to expressed opinion.

There is appreciable fetal salvage from cesarean section when the cord prolapses through a non-dilated cervix following early rupture of membranes. This is especially true with primiparae. The circulation in the cord must be strong and maintained to justify the operation. Repository attempts may succeed in other circumstances, or certain conditions may warrant conservative treatment with accepted risk of fetal loss. When the patient is elderly, primiparous or the social value of the child high, operation should be done promptly if reposition cannot be maintained.

In the presence of fetal malformation, no operation is justifiable except in the interest of the mother. Embryotomy, craniotomy, or cranial trypesis after adequate dilation is effected, are better procedures.

Elderly primipara are not to be assigned routinely to the operative list. Most of these patients beyond thirty-five years do as well in labor as the younger patients. However, they are in the last third of their childbearing years and in common with mankind in general have lived long enough to develop their share of hypertension, nephritis, cardiac lesions, diabetes, and other systemic and degenerative diseases. Since the childbearing years for them are few, the fetus develops a social value not obtainable in earlier years. Therefor, while from a purely obstetric standpoint the elderly primipara poses a cephalopelvic problem of little greater moment, conditioning factors make cesarean section a more frequent consequence.

We do not utilize cesarean section in many cardiac patients. Major consideration is given antepartum cardiac care and normal delivery anticipated unless there are other complicating factors. Our experience with delivery problems in more than 600 cardiacs justifies this opinion. A difficult, prolonged or infected labor is to be avoided in cardiac patients who have ever decompensated or threaten to do so. There is a place for section in cardiac patients but it is infrequently needed and never without competent consultation. It is not justified solely for purposes of sterilization. Postpartum sterilization is an operation so simply and easily done that cesarean section is never required to replace it.

What of patients who have had unsuccessful attempts at vaginal delivery, or who have fallen into the group with potential or actual intrauterine infection? We cannot forestall rupture of membranes hours or days before onset of labor, prolonged but ineffectual labor in borderline cases, "cervical dystocia" with days of pseudolabor and amnionitis, prolapse of foot early in labor in a borderline pelvis, and numberless other encountered conditions. We must often operate upon patients who have been examined originally many times or under careless conditions or where the anticipated vaginal delivery does not transpire in the borderline pelvis. Wrong judgment and the passage of time place these patients in the potentially infected group. Here an extraperitoneal cesarean section offers the best solution. Many will do well with transperitoneal or exclusion types of cervical segment operation, plus sulfa therapy. For all others, the choice is between the Porro operation or the extraperitoneal cesarean. We have no especial quarrel with the Porro operation if one

cannot do better. It is a sacrificial operation which carries in many expert hands a high mortality. We prefer the extraperitoneal operation and with good reason. Two hundred fifty extraperitoneal cesarean operations, with only two maternal deaths, done in our clinic in the manner proposed by the author, with uterus and function of childbearing conserved, are exhibited that you may place your own value on the operation for the indications we choose. The indication for the use of this type of extraperitoneal cesarean operation, therefore, is infection either potential or actual. In these worst of risks, over a period of ten years, with extraperitoneal operations performed upon 431 patients, there were five deaths; an uncorrected maternal mortality of 1.16 per cent. In 1,261 low segment operations in the same period, only on generally good risk patients, the mortality was thirteen or 1.03 per cent. The argument that retention of the infected uterus is dangerous and unwise is denied by factual experience, and not by biased, unconsidered, inadequate nor inexperienced opinion. The factor of peritoneal contamination is the all important one in determining whether or not the patient will recover. All other considerations are relatively unimportant.

And in conclusion, let us remember that no cesarean operation will serve the patient well unless preoperative care is well considered and administered. Proper food and fluid balance, chemotherapy, both prophylactic in the interest of baby as well as mother and therapeutic when indicated, hemotherapy, intravenous administration of amino acids in vomiting and starvation, and other supportive measures are imperative if one is to obtain consistently good results.

FRACTURES OF THE ACETABULUM*

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AMONG the varieties of fractures of the acetabulum that present problems in treatment, and which from a prognostic standpoint are of special interest are: (1) Fracture of the upper and posterior rim of the acetabulum associated with dislocation of the femoral head and displacement of a fragment, and (2) comminuted fractures of the acetabular floor with intrapelvic penetration of the femoral head.

In the following case reports, illustrative methods of handling these types of fractures are presented. Late evaluation of the end results in these cases clearly brought out the fact that the prognosis in such injuries must be guarded, regardless of the accuracy of reduction and the care taken to protect the joint from weight-bearing until consolidation is complete.

Fig. 1. Case 1. L. H. Roentgenogram taken one week after manipulation and traction, showing the acetabular fragment still displaced and the femoral head incompletely reduced.

CASE REPORTS

Case 1. L. H., a man forty-two years of age, was injured in a railroad accident on December 24, 1943, sustaining a posterior dislocation of the right hip which was complicated by a fracture of the upper and posterior rim of the acetabulum. A roentgenogram taken at the time of the injury showed the femoral head dislocated upward and backward, and the upper posterior rim of the acetabulum torn

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away and displaced in the same direction as the femoral head. An attempt was made by a local surgeon to reduce the dislocation by manipulation and the use of longitudinal skeletal traction, which was established by introducing a pin in the lower femur and applying forty pounds of weight. After twenty-four hours, the weight was reduced to thirty pounds, and later to fifteen pounds. Although the reduction of the hip was maintained by this means, the displaced fragment was not affected and upon the release of the traction, the femoral head again dislocated. (Fig. 1.)

Operative treatment was as follows: On January 5, 1944, the patient was placed prone on the operating table, with the right hip slightly elevated. General anesthesia was used.

The upper posterior rim of the acetabulum was approached by an incision that started just below the anterior superior spine, and following the line of the iliac crest, extended to the posterior superior spine. The incision was carried down through the periosteum of the crest. A subperiosteal dissection was carried out, exposing the fracture. The blood clots were removed. The dislocated femoral head was readily reduced. The lip fragment was replaced and fixed in position with a screw. (Fig. 2.)

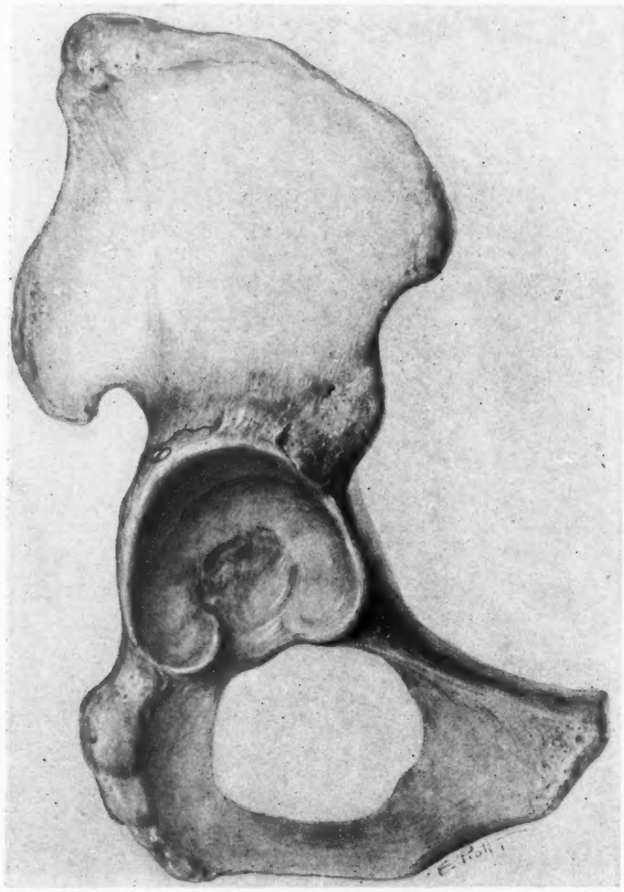

Fig. 2. Case 1. L. H. Acetabular fragment fixed in place with a screw.

The gluteal flap was replaced, and the periosteum sutured along the iliac crest. The skin was closed with interrupted sutures. A tightly fitted flannel spica was applied to provide compression.

Traction was established by means of a Steinmann pin, which had been placed in the lower femur prior to the surgical interference, and the application of ten pounds of weight, the object of this traction being to prevent the femoral head from pressing against the replaced acetabular fragment. This traction was maintained for a period of six weeks. During this time, roentgenograms were taken at regular intervals to check the position of the femoral head and the acetabular fragment.

Because of the complications of phlebitis and an embolus to the lung, this patient remained

in bed for three weeks after the traction had been removed. No motion at the hip was permitted during the entire two months that the patient remained in bed.

On March 8, 1944, the patient began to walk with the aid of crutches, and was encouraged to practice muscle contractions. At the end of March, he was touching the toe of the injured extremity to the floor.

By May, 1944, the motion at the hip was normal. The patient was walking well with the aid of a cane. On August 9, 1944, when the patient was last examined, he was walking well without support; there was no limp and the motion at the hip was normal. A roentgenogram showed the fragment in excellent position. (Fig. 3.) Although up to this writing, the functional recovery has been excellent, it is too early to determine the final outcome, in view of the possibility of the later development of degenerative changes following such injuries.

Case II. E. B., a male nineteen years of age, was injured in an automobile accident on January 31, 1942, sustaining a fracture of the upper acetabular rim associated with a posterior dislocation of the femoral head. (Fig. 4.)

Fig. 3. Case I. L. H. Roentgenogram taken seven months after fixation of the acetabular fragment.

Fig. 4. Case II. E. B. Roentgenogram showing posterior dislocation of the hip with displacement of a large fragment of the acetabular rim.

Fig. 5. Case II. E. B. Postoperative roentgenogram showing perfect position four days after reduction of the dislocation and fixation of the acetabular fragment.

Because of the size of the fragment, operative reduction was advised, but on account of the poor condition of the patient, interference had to be postponed for a week.

At operation a straight incision was made posterior to the greater trochanter, in the line of the femur. The muscles were separated,

FIG. 6. Case III. J. S. Roentgenogram taken following manipulation, showing acetabular fragment still displaced.

FIG. 7. Case III. J. S. Postoperative roentgenogram taken two years after reduction, showing mottling, necrosis, and flattening of the femoral head.

FIG. 8. Case III. J. S. Postoperative roentgenogram taken nearly six years after reduction, showing mottled density of the femoral head with distortion, and increased density of the entire acetabulum.

exposing the fracture. The dislocated femoral head was readily reduced, and the fragment replaced and fixed in position with a screw, which was directed upward and backward. (Figl 5.) The wound was closed. A plaster spica extending from the rib line to the ankle was applied, with the extremity in the position of slight eversion and abduction of twenty-five degrees.

Fig. 9. Case iv. E. G. Fracture of the acetabular floor with intrapelvic penetration of the femoral head.

Within two weeks the patient was walking with the aid of crutches. Eight weeks after the operation, the lower part of the plaster cast from the knee down was removed, and three months from the time of the injury, the remainder of the cast was removed. At that time weight-bearing was resumed.

This patient has perfect function of the hip at the present time (October 1944), and for two years he has been in the Air Force in Europe.

Case iii. J. S., a man forty-five years of age, on March 26, 1938, was thrown from a wagon, and one of the wheels ran over him. His right hip was dislocated posteriorly, and a large fragment was broken off from the upper posterior rim of the acetabulum, and displaced. On the same day as the injury, when the patient had recovered sufficiently from shock, an attempt was made to reduce the fracture dislocation by manipulation. The broken acetabular segment failed to fall into place. (Fig. 6.)

At operation on April 1, 1938, reduction and fixation of the fragment were carried out according to the technic that has been described under Case ii, except that a bone screw was used to anchor the fragment. Weight-bearing was begun in three months after the operation.

The hip recovered good function, there being only a slight limitation of motion in abduction and rotation. However, a roentgenogram taken in March, 1940, two years after the injury, showed evidence of mottling, necrosis, and flattening of the femoral head. (Fig. 7.) Another check roentgenogram taken on February 18, 1944, nearly six years after the injury, showed a mottled density of the femoral head with a small amount of distortion, and

increased density of the entire acetabulum. There was also partial destruction of the joint consistent with degenerative arthritis. (Fig. 8.) At that time, the hip had complete flexion movement, approximately thirty-five degrees of rotation, and abduction of twenty-five degrees.

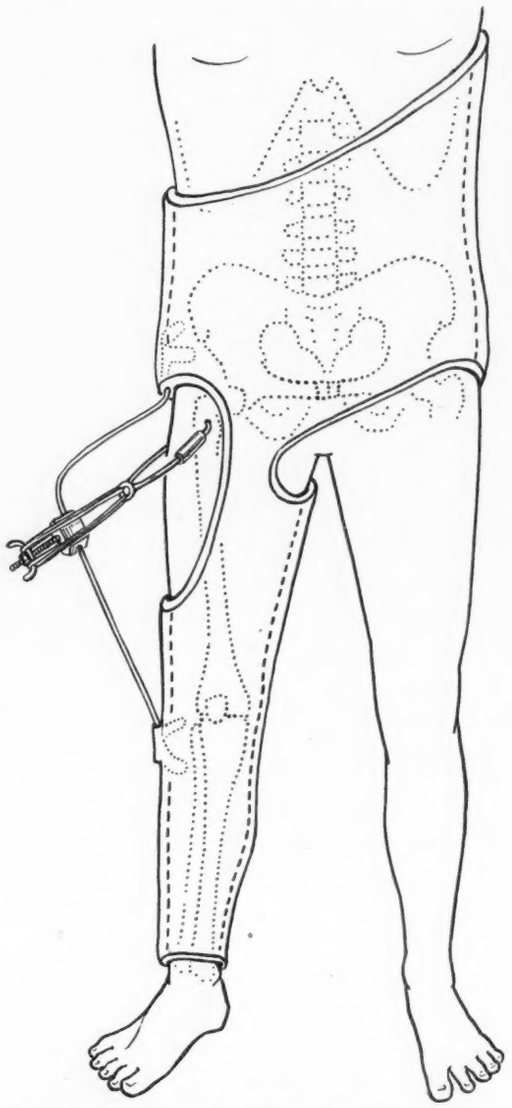

Fig. 10. Case iv. E. G. An outrigger equipment to provide for lateral traction.

COMMENT

In two of the cases that have been reported, surgical replacement of the acetabular fragment was carried out when the fragment failed to fall into normal position upon manipulative reduction of the dislocated femoral head. In the third case operative indications were recognized immediately. Surgical fixation is practically always indicated in fractures at a dependent point of the acetabular rim, and in addition to ensuring anatomical replacement, fixation has the advantage of shortening the convalescence and of promoting early union.

Case iii illustrates the development of necrosis of the femoral head after a period of apparent recovery. Two years after operative fixation, abnormal changes had appeared in the femoral head, and six years after the injury, there was extensive destruction of the hip joint. The significance from an industrial standpoint of such delayed degeneration of the femoral head, which produces an arthritic hip with limited and painful motion, is manifest.

Case iv. E. G., a man fifty-three years of age, on January 18, 1942, received a fracture of the acetabulum in an automobile accident. Following the injury he was in severe shock, and the abdomen was distended slightly. Roentgenographic examination of the hip showed the floor of the acetabulum driven inward in one piece. (Fig. 9.) Two days after the fracture, when the patient had recovered from shock, reduction was carried out as follows:

With the patient under spinal anesthesia, a Kirschner wire was inserted through the base of the greater trochanter at a right angle to the shaft of the femur. A plaster spica with a long outrigger equipment incorporated was applied to the pelvis and the injured extremity. (Fig. 10.) An opening was made in the cast of sufficient size to allow for the correction of deformity, visualization, and adjustment. Traction in the line of the femoral neck was established by means of elastic bands. (An attempt to palpate the fragments through the rectum was only moderately satisfactory.) Roentgenographic examination following the application of the traction showed that the femoral head had been pulled out and was in good position. (Fig. 11.)

Six weeks after the reduction, the plaster spica was removed, and the patient began to walk with the aid of crutches. Active motion at the hip was started, but no weight-bearing was permitted. At the end of three months from the time of the injury, the patient began to bear weight. Throughout the convalescence,

roentgenograms were taken to check the position.

One year after the injury, roentgenograms showed a well healed and reconstituted acetabular floor, and a good joint space. Clinically, there was slight limitation in external rotation and abduction; other motions were free. The patient had no limp. Further roentgenograms were taken in October, 1944, two and a half years after the injury. At that time the joint space was narrowed, there were proliferative changes about the femoral head and acetabulum, and there was some distortion of the acetabulum. (Fig. 12.) Clinically, abduction and rotary motions were definitely limited.

Fig. 11. Case iv. E. G. Roentgenogram showing the femoral head pulled out of the cotyloid cavity by lateral traction.

Fig. 12. Case iv. E. G. Roentgenogram taken two and one-half years after reduction by traction, showing a narrowed joint space, with proliferative changes about the femoral head and acetabulum, and some distortion of the acetabulum.

COMMENT

Case iv illustrates again the development of late destructive changes in the hip joint. Whereas one year after the injury, there was a good joint space and a well constructed acetabular floor, one and a half years later, roentgenograms showed marked destructive changes in the joint. Motions at the joint were markedly decreased.

This patient had been treated by establishing lateral traction. Although this is the generally recognized treatment of intrapelvic dislocations of the femoral head, when the capsular attachments of the acetabular fragments are torn, few methods of obtaining such lateral traction have been suggested. For the most part, attempts to provide lateral traction by means of adhesive tape on the thigh, with weights attached, have been abandoned. Methods of obtaining more direct traction by means of introducing a Steinmann pin, nail, or screw in the trochanteric region, and establishing a continuous pull, have been suggested by Putti, Leveuf, Fitte, and Moore.

Putti's method consists of introducing a nail vertically through the greater trochanter by two incisions, one for its entrance and one for its exit. Both ends of the nail protrude, and to them is attached elastic that is fixed to a metallic arch

incorporated in a femoral-pelvic cast. Traction is exerted manually in both directions before the plaster cast is applied.

In Leveuf's method, a long nail is introduced into the lower part of the femoral neck, and a plaster cast is applied extending to the knee, with a window cut out over the trochanteric region. Reduction is obtained by means of a special metallic apparatus that is incorporated in the plaster cast and attached to the nail. It is Leveuf's opinion that in extreme displacements of the femoral head, it is more efficient to introduce the nail into the femoral neck than into the greater trochanter. Leveuf later used a screw in place of the nail, which is less likely to slip before consolidation is complete. Successful use of this method has been reported by Rigal, who added a weight to the regular metallic apparatus, in order to obtain longitudinal reduction.

SUMMARY

Three cases of fracture of the acetabular rim associated with a posterior dislocation of the hip have been presented. Surgical replacement of the acetabular fragment has been described.

One case of fracture of the floor of the acetabulum associated with intrapelvic dislocation of the femoral head has been presented. A method of obtaining lateral traction by means of an outrigger incorporated in a plaster cast has been described.

Late examination in one case of fracture of the acetabular rim and in the case of intrapelvic dislocation showed degenerative changes in the joint, confirming the general opinion that final results in these cases must not be evaluated until from two to three years after the injury. The prognosis would seem to be more favorable when anatomical reduction is carried out early, and when the patient is not permitted to bear weight until the fracture is well healed.

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PAGET'S DISEASE OF THE NIPPLE

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THE relative rarity of Paget's disease of the nipple and the discrepancy of opinion as to its pathogenesis and management has prompted this critical review. Based upon personal observation, I believe that Paget's disease is not a precancerous lesion but is a malignancy from its very onset. Untreated or inadequately treated, Paget's disease is as invariably malignant as any other mammary carcinoma. While there probably is a natural temptation to be conservative in treating Paget's disease of the nipple when there are no clinical signs of underlying breast involvement, nevertheless, this attitude should be condemned.

Clinically, I have seen what appeared to be an innocuous lesion of the nipple (histologically Paget's disease) without any palpable masses in the breast, develop axillary metastases fourteen months after mastectomy and postoperative radiation. Likewise, I have seen histologically proven axillary metastasis from an isolated lesion in the nipple without gross involvement of the intervening breast tissue. However, the presence of a Paget's disease of the nipple and a concomitant underlying intramammary carcinoma is the more frequent observation in the neglected cases. Late cases show generalized metastasis.

An analysis of cases of this type coupled with a consideration of the pathogenesis of Paget's disease certainly favors radical mastectomy and axillary dissection as the treatment of choice. It is fortunate that the lesion is readily accessible so that biopsy may be performed and an early diagnosis obtained.

The first cognizance of a surface lesion of the nipple is attributed to Velpeau in 1840. The association of the lesion of the nipple with carcinoma of the breast was not considered until 1874, when Paget described 15 cases of an eruption of the nipple, some of which were accompanied by an underlying carcinoma. The relationship of the surface lesion with the deep seated neoplasm has been a source of contention and various theories have been advanced by Cheattle,[1] by Bloodgood, by MacFarland[2] and by Muir.[3]

We feel that the most substantial theory is that of Keith Inglis.[4] His pathological studies show that Paget's disease is a malignant disease from its very onset. The lesion starts at the junction of the lactiferous duct with the epidermis or in a duct very close to its outlet. From this location, without the formation of any nodule, the malignant cells spread centrifugally and continuously within the confines of the surface epithelium. It permeates peripherally into the epidermis of the nipple and distally between the epithelial cells lining the duct walls down to the acini. Consequently, a cross section of the nipple may reveal two adjacent ducts, one involved by the neoplasm and the other free of disease.

Apparently in Paget's disease, the type of spread of malignancy is unique inasmuch as the extension is intra-epithelial. When first observed, there is no break through the subjacent connective tissue. A cross section of a duct would show a ring of neoplastic cells in the very substance of the epithelial lining. A three dimensional visualization would be a hollow cylinder of cells within the duct lining. In the more advanced stage, the malignant cells break through into the lumen of the duct so that cancer cells are observed intraluminary without any connective tissue stroma support. The ducts themselves do not undergo neoplastic proliferation; the lining epithelium is

merely being invaded. Contrast this with an intraductal carcinoma in which there is an out growth of neoplastic tissue from the duct wall in a more or less complex papillary arrangement with supporting axial strands of connective tissue. Likewise, contrast this with the neoplastic lesion that from its very onset extends beyond the basement membrane into the connective tissue.

The intra-epithelial neoplastic cell—the Paget cell—has a characteristic appearance. It represents a malignant epithelial cell growing in non-neoplastic epithelium, in ducts as well as in epidermis. The cells are large, have deeply staining nucleus and pale clear shrunken cytoplasm. The appearance of vacuolation is due to the formation of clefts between the Paget cells and the adjacent epithelial cells. Dr. R. J. Ludford, from cytological studies, believes that the Paget cell arises from the basal layers of the epidermis. He finds the active development of these cells in the rete Malphighi, while at a higher level they tend to become degenerated. There seems to be an inherent tendency for the Paget cells to undergo early degeneration and necrosis.

This degeneration accounts for the fact that groups of Paget cells may be separated by normal epithelium. In all probability, the intervening neoplastic tissue had degenerated. Clinically, this explains the appearance of fresh, isolated minute foci at the margin of the nipple. The tendency for degeneration and death of Paget cells is almost equal to the rate of proliferation, therefore, the advancing margin extends very slowly. Another factor in the slow course of the disease is that Paget cells are inhibited from exerting their full malignant properties by the restraining influence of the duct wall. The slow development of the disease is illustrated by Jamieson's case which remained dormant for twenty years and Darier's case which remained dormant for eleven years. In both instances, scirrhous carcinoma eventually developed.

If we adhere to the concept of Keith Inglis, that the point of origin of Paget's disease is the duct-skin junction, then the peripheral infiltration will produce extensive undermining of the areolar epithelium with neoplastic cells. These cells will eventually break through the epidermis producing ulceration at several points with apparent normal intervening epithelium or skin. At a later time, this same process may extend downward into the duct system and a neoplastic mass may appear in the substance of the breast. Occasionally, the first evidence of extension is into the breast and the nipple involvement may appear subsequently as a delayed direct surface extension. In the duct lesion, the neoplastic cells fill the lumen; while in the skin lesion, the Paget cells are thrown off with the discharge. Fresh scrapings about the nipple, when properly prepared for histological study, may show malignant cells.

On rare occasions, Paget's disease has given rise to carcinoma in the connective tissue of the breast. The breakaway is never from the skin surface but rather from the duct or acini.

As a result of the intra-epithelial Paget cells, the skin about the nipple may at first be thrown into prominent folds. This thickening is augmented by the underlying inflammatory zone in the connective tissue. The presence of the neoplastic cells stimulates the inflammatory reaction which consists of a broad band of subepithelial lymphocytic and plasma cell infiltration. This inflammatory zone is one of the pathognomonic features of Paget's disease. It is inconspicuous around the ducts, being apparently limited to the subepithelial area and the area around the blood vessel.

The superficial portion of the epithelium may be thinned out and atrophic as a result of trophic and lymphatic disturbances. Consequently the neoplasm may extend directly through the skin and form a malignant ulcer.

The usual appearance of the nipple of Paget's disease is a reddish, dry lesion covered by fine scales. Later there is a

cracking and crusting with a discharge from the nipple which varies from clear to blood stained. When there is extension down an isolated duct or ducts, there is an associated inflammatory fibrous thickening in the adjacent tissue which can be palpated as a nodule. There may be a hard definite edge to the areolar. With a widespread involvement, one finds a diffuse thickening rather than an isolated nodule. After the disease has existed for several years, there is some obliteration of the ducts, with subsequent periductal fibrosis. This causes retraction of the nipple in the absence of infiltrating carcinoma. The patient usually seeks medical assistance when there is a bright red, raw looking nipple that has failed to respond to her own treatment.

In the differential diagnosis of Paget's disease, the following should be considered: eczema, syphilis infection (e.g., secondary to human bite), invasion of the nipple from carcinoma below and carcinoma of an epitheliomatous nature or from a sebaceous gland. In eczema, the lesion is soft, moist and pliable. In Paget's disease, the lesion is somewhat indurated. Generally speaking, lesions of the nipple are much too serious to depend entirely upon clinical diagnosis. All suspicious lesions of the nipple should be submitted for histological study. A specimen from the spreading margin, in the case of Paget's disease, will usually reveal the characteristic invading Paget cells. In eczema, there is an increased thickness of the epidermis with elongated interpapillary processes. There is considerable inflammatory reaction in the dermis. The characteristic findings of Paget's disease are absent.

In view of the nature of Paget's disease and its mode of dissemination, the futility of local treatment to the nipple is obvious. While superficial radium or *x*-ray might cure the skin lesion, the underlying carcinoma of the ducts is unaffected. With a biopsy report of Paget's disease from an isolated nipple lesion, radical mastectomy is the procedure of choice. This was advocated by Bloodgood[5] in 1924. I wholeheartedly agree with his point of view.

SUMMARY

1. Paget's disease is a malignant disease from its onset even when there is only an isolated involvement of the nipple, the disease having the potentialities of any other malignant tumor. It starts at the junction of the lactiferous duct with the epidermis and spreads toward the skin and into the duct system. A deep seated scirrhous carcinoma is part and parcel of the same disease.

2. A specimen for biopsy should be obtained in all doubtful cases. The characteristic intra-epithelial Paget cells in the epidermis and in the ducts and the characteristic subepithelial inflammatory reaction are diagnostic.

3. Local treatment to the nipple is useless. Radical mastectomy offers the best opportunity for cure.

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ASYMPTOMATIC PYURIA IN YOUNG MEN*

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WHEN white blood cells exceeding what is considered a normal number are found in the urine, one immediately sets out to look for a pathological condition in the urinary tract and usually finds it. In such patients, symptoms and signs referable to disease of the urological tract are present. However, there are young men with serious disorders of the urological tract who complain of no symptoms and who give as the only clue to the existing condition the presence of leucocytes in occasional specimens of urine. Not all specimens of urine taken from these young men will contain pus cells. It is readily apparent then that these men can enter naval and military services undetected because at the time of enlistment they possess clear urines; but once in the service, when the frequency of physical examinations increases, either in the nature of annual physicals, or for promotions, or for change of tour of duty, the chances of discovering an abnormal urine specimen increase. Then the search for a pathological process along the urological tract is carried out.

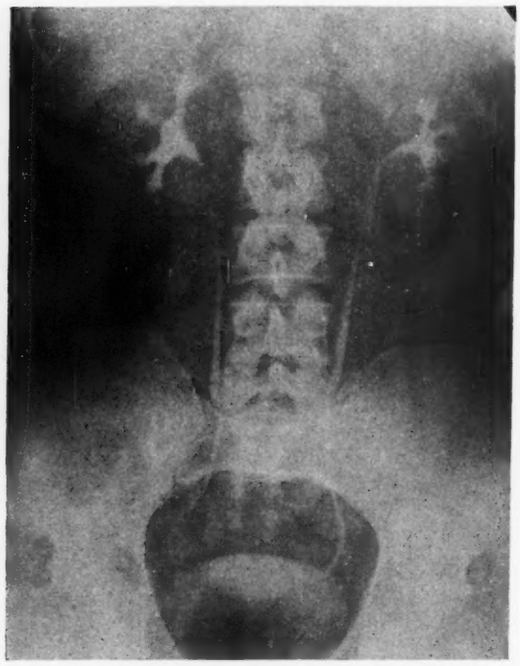

FIG. 1. Case 1. Double kidney on the left side with incomplete duplication of the ureter. Only one ureteral opening into the left side of the trigone.

In a moderately sized Naval mobile hospital unit in the tropics, fifteen men out of eighty who were given complete urological work-ups and who were considered good physical specimens, cast off showers of white blood cells in their urines at one time or another. The principal reason for their being referred to urology was the presence of white blood cells in their urines. Some were hospital patients in wards other than the urological and were turned over to us when routine urinalyses disclosed the presence of white blood cells. Others were detected during routine physical examinations for promotion or transfer. In five of these fifteen patients a serious upper urological tract condition was found. Three cases were anomalies of the kidney, one was a bilateral hydronephrosis, and the fifth was a large stone of the kidney pelvis with consequent hydronephrosis of that side. Of the remaining ten patients, two were found to have inflammatory strictures of the ureters, two had chronic prostatitis, and in six no disorder of the urological tract could be found. These six patients were discharged with the diagnosis of "no disease." All patients had showers of pus cells in their urines at one time or another. All were good physical specimens without apparent disability, and all were under

* The opinions or assertions contained herein are the private ones of the writer and are not to be construed as official or reflecting the views of the Navy Department or the Naval Service at large.

twenty-six years of age except the patient with stone who was thirty-seven.

Various authors have different standards by which they judge normal urinary specimens on microscopic appearance.

For example, Helmholz believes that in males only two to three leucocytes per low power field is normal, while Moore finds that the average leucocyte content was always less than four per high power field in cases in which urinary diseases could be definitely excluded. However,

Fig. 2. Case II. Double kidney on the left side with complete duplication of the left ureter. Two ureteral openings in the left side of trigone.

Fig. 3. Case III. Crossed renal ectopia. Two kidneys on left side, none on the right. Left kidney rotated 180 degrees, right rotated 90 degrees.

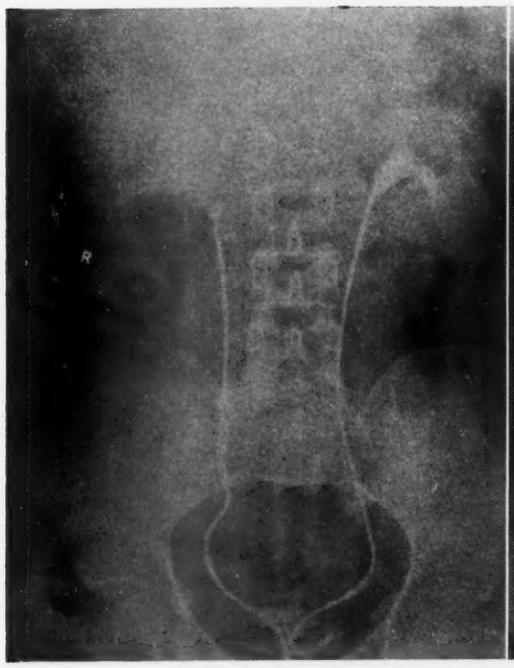

Fig. 4. Case IV. Silent stone in right kidney pelvis serving as a ball-valve at the pelvic outlet.

Fig. 5. Case V. Symptomless bilateral hydronephrosis in a robust twenty-six year old male.

Eisendrath and Rolnick believe that five to seven white blood cells per high power field are still considered normal, while Hepler states that eight cells per high power field is still considered normal. All these findings have been recorded on centrifuged specimens of urine.

CASE REPORTS

Case I. A twenty-six year old male was sent in because of occasional cloudy urine. He gave a history of having had an urethral discharge several months previously, which was always negative for gonococci. On admission here, a urinalysis showed a few white blood cells. He complained of no symptoms whatsoever, and there were no signs referable to the genitourinary tract. Cystoscopy and retrograde pyelograms revealed the presence of a double kidney on the left side with incomplete duplication of the ureter. (Fig. 1.)

There was only one ureteral opening on the left side of the trigone. Fusion of both left ureters took place about 8 cm. above the intramural portion of the bladder.

Case II. A twenty-two year old boy who had never been ill a day in his life came into the hospital for a routine examination and urinalysis for transfer to the diving school. The centrifuged urine showed ten to fifteen white blood cells per high power field. The patient was an excellent physical specimen. Repeated urinalyses showed three to four white blood cells in the next three specimens. At cystoscopy, two ureteral orifices were seen at the left angle of the trigone and one opening on the right. A No. 6 French opaque catheter was easily placed in the left renal pelvis, and it was possible to pass only a No. 5 in the second opening on the left side for a distance of 7 cm.

Retrograde pyelograms showed a double kidney on the left side with complete duplication of the ureter on the same side. (Fig. 2.)

Case III. A twenty-three year old boy was on the medical service complaining of generalized aches and pains. Several specimens of urine were loaded with white blood cells, and others had none. Retrograde pyelograms revealed the presence of two kidneys on the left side and none on the right. The left kidney was seen (Fig. 3) rotated 180 degrees with its laterally placed pelvis. The lower or ectopic crossed kidney was seen rotated 90 degrees with marked dilatation of the pelvis. The right ureter crossed over to the left side at the level of the fifth lumbar vertebra. This was a case of crossed renal ectopia. Pus cells in abnormal quantities were recovered from both kidneys.

Case IV. A thirty-seven year old male had been on the medical service with the complaint of arthritis. On admission, a specimen of his urine contained large quantities of leucocytes and repeated analyses of the urine were negative on several other occasions. He was referred to us to rule out a possible focus of infection in the urological tract.

Retrograde pyelogram (Fig. 4) showed the presence of a stone in the right kidney pelvis.

Case V. A twenty-six year old male had urethral discharge three weeks before admission, which was always negative for gonococci and which responded to sulfadiazine therapy. On urinalysis two weeks later his medical officer was able to detect the presence of leucocytes in occasional specimens and he was referred to us for that sole reason. He had no symptoms whatsoever. Retrograde pyelograms (Fig. 5) revealed the presence of bilateral hydronephrosis.

SUMMARY

Eighty patients have had complete urological work-ups on this base in the last six months. Fifteen of these patients had no symptoms whatsoever, and they were given a complete urological work-up solely because of the presence of white blood cells in occasional specimens of urine. In five patients, a serious urological disorder was found. In only six of these fifteen asymptomatic cases, no pathological condition was found.

The importance of investigating any young man who has leucocytes in his urine whether persistent or sporadic in spite of the fact that he is without symptoms is stressed. Its significance is apparent from our small series of cases.

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ETHYL ALCOHOL INTRAVENOUSLY AS POSTOPERATIVE SEDATIVE

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A NUMBER of years ago, in 1920 to be exact, I became convinced that alcohol given intravenously could be beneficially used as a treatment for septicemia. The first patient with puerperal septicemia to be so treated was greatly benefited. Since this initial case I have on many occasions intravenously injected alcohol properly diluted for generalized infections with considerable success. During these treatments it was noted that quickly following the intravenous injection of alcohol, patients became quieter and usually entered upon a peaceful slumber. This suggested that alcohol given intravenously might with benefit be used as a narcotic, thus taking the place of morphine as a routine postoperative sedative.

Alcohol belongs to the group of cerebral depressants and lessens the sensitivity to pain. It affects first the cerebrum, then the cord, and last of all, the respiratory centers, while morphine depresses the respiratory centers simultaneously with the depression of the cerebrum and to a lesser extent, the reflex excitability of the cord.* Thus alcohol should prove more effective as a postoperative sedative than morphine.

In thirty consecutive cases in which I have given alcohol intravenously, I have found it necessary only occasionally to bolster the effect of the alcohol with morphine to relieve pain. At times the injection produces a feeling of exhilaration. One patient was badly intoxicated by a single injection. In no patient did we notice any deleterious effect. In several instances we thought that the immediate post-operative course of the patient was easier, quieter, and less disturbed than was usual in cases of similar operative type in which alcohol had not been used.

I have also given alcohol intravenously in proper dilution to insane and restless individuals with beneficial results. Quiet and sedation quickly followed its introduction.

The intravenous injection of alcohol has also proved to be of value in the treatment of alcoholics who, deprived of their usual stimulant, were in the restless and ungovernable period of delirium tremens. Because of vomiting from an irritated stomach, they could not take whiskey by mouth.

Alcohol intravenously was also used as a ready means of supplying energy to severely debilitated and weakened individuals and to those in sudden asthenic crises and shock. A good example was a marasmatic child who was unable to assimilate nourishment. Alcohol, plus amino-acetic acid in proper dilution in glucose, 5 per cent, and saline solution, was given intravenously. The child quickly recovered.

Intravenous alcohol was also found to be of value in diabetics who were in coma and required quickly utilizable energizing substances.

It was found that properly diluted alcohol used intravenously acted in a phenomenal manner in abolishing pain. It increased the peripheral circulation in patients with diabetic gangrene of the extremities and produced routine postoperative sedation and rest.

We have also given alcohol intravenously as a means of obtaining relaxing sleep in the excitable states so frequently present in paranoiacs.

* MEYER, H. H. and GOTTLIEB, R. Pharmacology. P. 29. Philadelphia, 1914. J. B. Lippincott.

TABLE I

	Adhesions, intra-abdominal	Appendicitis, acute	Hernia, retroversion of uterus	Gallbladder; cholecystectomy	Tubal pregnancy	Appendicitis, subacute	Appendicitis, chronic	Fibroid	Kidney ptosis	Thyroid	Intestinal obstruction	Hernia	Synovectomy, knee	Pain: Severe	Pain: Slight	Pain: None	Irritable and restless	Resting well	Sleep: None	Sleep: Interrupted	Sleep: Good	Morphine	Special Symptoms
	4	6	2	4	2	3	2	1	1	1	2	1	1	5	4	20	7	23	2	8	20	5	
1	x															x		x		x			Slept at short intervals, had fair night
2		x													x			x		x			Fairly good night; slight pain
3			x													x		x			x		Ventral hernia and retroversion of uterus
4				x										x			x			x		x	Had to have morphine sulfate
5					x											x		x			x		Had fair day
6					x											x		x			x		Patient had numerous dense adhesions
7		x													x		x			x			Fairly good operative day
8						x										x		x			x		Perspiring, face flushed
9							x							x			x		x				Alcohol had no perceptible effect
10						x								x				x			x		Went to sleep after injection; felt like being drunk
11		x														x		x			x		Patient had flushed face, felt warm
12				x												x		x			x		Perspired freely, face flushed; inj. by hyperdermoclysis
13							x							x				x		x		x	Drowsy, had to give morphine for pain
14	x	4														x		x			x		Had good postoperative day; heat to abdomen,
15		x														x		x			x		Restless; had poor day
16		x														x		x			x	x	Only 1 inj. morphine necessary 8 hr. after intrav. inj.
17						x										x		x			x		Drowsy and tingling sensation throughout body
18				x										x				x			x		Had pain but slept well after injection
19								x							x		x			x			Did not affect pain in lower abdomen
20									x							x		x			x		Had restful night; patient fairly comfortable
21										x						x		x			x		Complained of vertigo after injection was started
22	x														x		x				x		Vertigo
23											x					x		x	x				Patient quiet although she did not go to sleep
24				x												x		x			x		Good postoperative day
25	x															x		x			x		Patient very drowsy; could not stay awake
26												x				x		x			x		Has a fair day
27													x			x		x			x		Patient slightly intoxicated
28											x					x	x				x	x	Patient very restless
29	x																x		x			x	Patient very restless and uncooperative
30				x												x		x		x			Patient perspired moderately, pulse accelerated

Above cases were compiled from March 19, 1944 to July 13, 1944.

In most instances alcohol given intravenously postoperatively can replace the usual doses of morphine or other narcotics. The alcohol employed is the ordinary ethyl (95 per cent) alcohol as obtained from the manufacturers. Before intravenous injection, it is diluted with at least 120 to 240 cc. of saline solution or it may be added to the usual intravenous postoperative glucose, 5 per cent, and saline. As a rule we add 50 cc. of pure 95 per cent ethyl alcohol to 1,000 cc. of the glucose, 5 per cent, and saline solution. The rate of flow is regulated so as not to exceed more than 60 drops per minute. Intravenous injection of alcohol, if given too rapidly, may be painful and in a few patients has caused a slight sensation of syncope.

During the injection the patient very quickly experiences a feeling of well being

and is conscious of a gentle superficial warmth. If the pain for which the alcohol injection is given is not controlled and an excitable state persists, the injection may be repeated. In one patient, due to a nurse's misinterpretation of directions, 200 cc. of alcohol was given in twenty-four hours without deleterious effects except that it produced a too sound sleep associated with restlessness and a muttering stupor.

I have compiled a list of thirty consecutive operative cases in which intravenous alcohol was given postoperatively. Of these there were only five patients who postoperatively required morphine in addition to the alcohol. See table in next column.

The thirty listed cases include four of abdominal adhesions, six of acute appendicitis, two incisional hernias with retroversion of uterus, four of acute cholecystitis, two tubal pregnancies, three of subacute appendicitis, two of chronic appendicitis, one hysterectomy, one ptosis of kidney, one thyroidectomy, two of intestinal obstruction, one inguinal hernia, and one synovectomy (knee).

1	(4)	Mrs. A.	Cholecystitis	gr. 1/8
2	(13)	Miss B.	Chronic appendicitis	gr. 1/6
3	(16)	Mr. C.	Acute appendicitis	One inj. morphine 8 hrs. after alcohol injection.
4	(28)	Mr. D.	Intestinal obstruction	gr. 1/8
5	(29)	Mr. E.	Adhesions; chronic appendicitis	gr. 1/6

The results after intravenous injection of alcohol in glucose and saline were as follows: twenty had no pain, four had slight pain, in five pain was still severe, twenty-three rested well, seven were restless, two did not sleep, eight slept at intervals, twenty slept well, in one instance the effect on pain was not recorded.

Tabulated presentations of the results of the intravenous injection of alcohol are shown in Table 1.

AN AMBULANT METHOD FOR THE TREATMENT OF PILONIDAL DISEASE*

A PRELIMINARY REPORT

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WE have hesitated to present a paper on this method of treatment because all the cases except one occurred in our office practice and because of the small number of patients treated. However, the results, so far achieved, seem, we believe, to merit the presentation.

Seven patients were treated in all. They ranged from primary abscess formation to one patient with sinuses which were of twenty years' duration. Specifically there were two cases of primary abscess, two with recurrent abscess in an old operative scar. Two had a discharging sinus, one of which was a postoperative recurrence. One patient had three openings with sinuses (one of which was discharging), together with acute inflammation of the left buttock. In the group were five males and two females.

METHOD OF TREATMENT

The patient is prepared by a thorough shaving of the operative area. It is important to keep the hair shaved about the wound while it is healing. The abscess or sinus is incised after skin infiltration with a water soluble analgesic. The tracts are opened by cutting down on a probe or groove director at different stages, so as not to have too large a wound. If more than one incision is contemplated, it is well to allow the wound made previously to fill with granulations partially before another incision is attempted. The wound, if there is much oozing, is packed with iodoform gauze. This gauze is removed on the second day. The wound is cleansed of any loose detritus by swabbing with hydrogen peroxide. The wound is then explored with a fine probe in order to ascertain its direction and also to see if there are any ramifications.

A solution which we had prepared for us is used to swab out the wound and to saturate the plain gauze packing which is inserted after the swabbing. The wound is kept packed with saturated gauze until the healing has reached the surface. Treatments following the incision are given every other day for eight or ten days or until the wound shows a healthy appearance. Thereafter twice weekly.

SOLUTION

The solution, which is composed of ethylaminobenzoate twenty-five parts and phenmethylol seventy-five parts, when introduced into the wound produces a superficial, grayish-white coagulum accompanied by a slight burning sensation which shortly after changes to numbness. The lining membrane of the abscess or sinus apparently undergoes dehydration and after a few treatments desquamates leaving a healthy appearing surface. The solution seems to affect only the abnormal tissue. We have noticed when practically all the abnormal tissue has disappeared from the wound, and a small grayish-yellow spot still remains, this is a clue to probe for a possible extension of the tract. In probing one may also use the solution to advantage because of its anesthetic properties. Occasionally an excoriation around the wound edges is caused by the secretions. This is controlled by applying zinc oxide ointment.

* Read before the New York Proctologic Society October 19, 1944.

DURATION OF TREATMENT

The duration of treatment has been from eight to twelve weeks. It must be borne in mind that in every case, these patients have been at work all during the treatments. None of these patients is necessarily confined to his home more than one day.

RESULTS

Of the seven patients, four have had no recurrence in from one to three years. One patient completed his treatments two months ago. One patient was called into the Navy before he could complete his treatments. In another case the patient had his abscess incised and was treated three times, then he discontinued coming and the wound healed. He was free of symptoms for four years. He then had a recurrence at which time an abscess was again incised and a tuft of hair removed. One postoperative treatment was given. He has been free from any recurrence over two years. He feels good except when there is a change in the weather at which time he has a slight pain in the area.

SUMMARY AND CONCLUSION

The treatment is an office procedure. The incision by stages leaves no large gaping wound thus obviating the confinement of the patient. The solution does not destroy the normal tissue and is an analgesic. The patient loses very few hours from his work. Further trial will be necessary in order to evaluate this method of treatment properly.

UNDESCENDED TESTICLE

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THE ease with which the undescended testicle may be placed in the scrotum varies greatly. In difficult cases tedious and painstaking dissection is necessary. The testicle must be freed with sufficient length to reach the scrotum without tension. If any considerable tension is required to hold it there, the vascular supply of the testicle will be interfered with and it will not develop properly.

The proper age for operation is between eight and nine years. In our experience the anterior pituitary-like substances have been of no avail, and when observing the mechanical nature of the disorder it is not reasonable to expect a hormone or medicine to help.

An inguinal incision is made and the external oblique fascia incised. The testicle is exposed and first dissected free from its most distal attachment and also from its peritoneal attachment.

As there is practically always a hernial sac associated, attention is then given to this. It is usually necessary to dissect the fine layer of peritoneum off the cord for the dorsal portion of the sac. The sac is then closed, but not transplanted. The most important place to free adhesions in addition to freeing the cord from its dorsal peritoneal attachment is along the posterior surface of the dorsal layer of the hernial sac. The internal oblique muscle and the closed sac must be lifted by gentle retraction and the dissection pursued as high up as can be reached. No other maneuver will derive so much length for the cord and in many cases the failure to do this will prevent the testicle from being lengthened sufficiently to bring it into the sac.

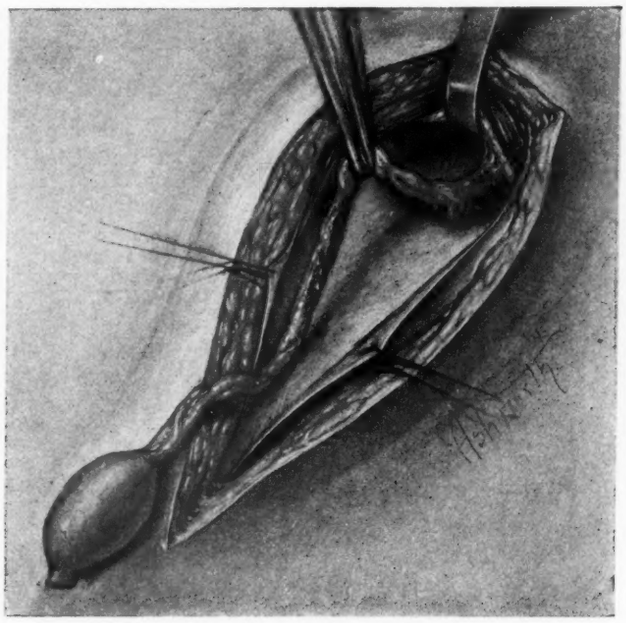

FIG. 1. Dissection of the spermatic cord from the underneath surface of the posterior peritoneal wall after closure of the sack.

If the case is bilateral only one side should be operated upon at one sitting, the other being done a week later. If both sides are attempted on the same day, speed and hurry will inadvertently creep in and defeat the careful dissection in some cases.

The modified Ferguson type hernial repair is used for closure. A purse-string suture in the deep layer of the superficial fascia is taken at the top of the scrotum to help keep the testicle from working up into the groin. A suture of kaldermic No. 1 is placed in the tunica vaginalis of the testicle and brought out in two adjacent places through the scrotum and a rubber band attached to it and strapped to the leg with very slight traction. The legs are not strapped together so that flexion of the thigh may release the traction from time to time. At the end of four days this suture is removed.

SUMMARY

1. Various points in relation to surgery of the undescended testicle are discussed.

2. The freeing of adhesions from the underneath surface of the hernial sac high above the internal inguinal ring is of the most valuable aid in lengthening the cord.

Bilateral vasectomy is frequently done preliminary to prostatectomy to avoid postoperative epididymitis. This operation is also indicated when sterilization of the male is advisable.

From "Operations of General Surgery" by Thomas G. Orr (W. B. Saunders Company).

A PROCEDURE FOR PREVENTING WOUND CONTAMINATION DURING APPENDECTOMY

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EVERY surgeon has had the experience of having an acute gangrenous appendix burst during its removal. The subsequent contamination of the operative incision often results in a wound infection. Such infections increase the patient's period of hospitalization by many days and often weeks.

In the operative management of a patient with gangrenous appendicitis we have employed a simple method against wound contamination. By employing a sterile finger cot over the inflamed appendix, contamination of the operative field is prevented even if the appendix should perforate during its manipulation.

Our procedure is very simple. After the appendix has been liberated from its mesenteric attachment, a sterile finger cot is placed over the appendix distally as far as necessary. At the distal end the finger cot is either clamped or ligated snugly about the appendix. (Fig. 1.) Appendectomy is then completed in the routine fashion, and the specimen is removed encased in the rubber sheath.

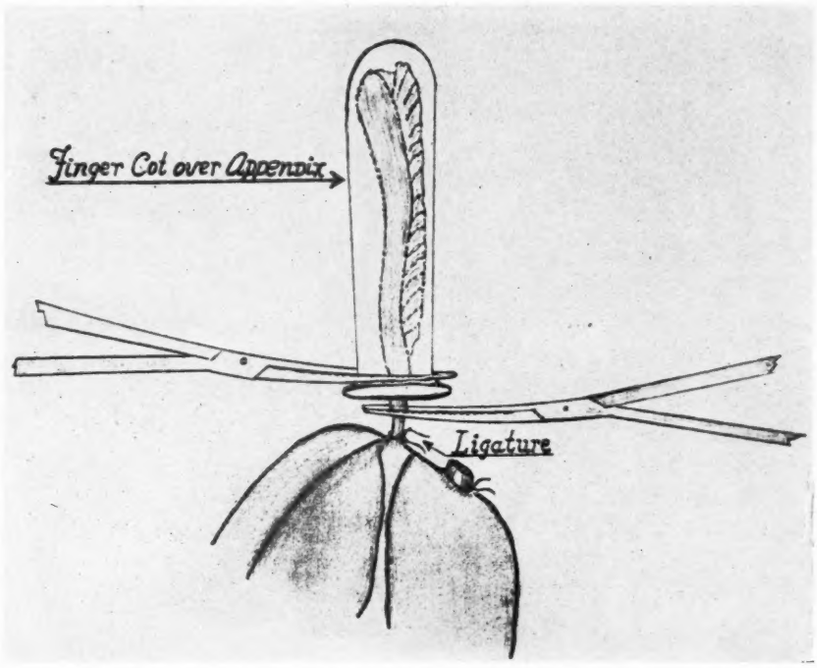

FIG. 1. The appendix is encased in a finger cot which is held securely with a clamp. An alternate method is to employ a ligature in place of the clamp.

The finger cots employed are sterilized similar to the ordinary rubber drains and are kept in the same solution with the drains. On occasion when cots were not available, we have employed rubber fingers removed from old discarded rubber gloves.

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The utilization of this method has been most facile and easy to follow. In those patients in whom the condition is most acute, the appendix is most distended and the cot is applied with greater ease. When the appendix is only slightly inflamed this procedure is not as easy to follow. However, in such instances the danger of perforation is not present.

On the occasions when this method has been employed, it is believed that the incidence of wound infections has been lowered via this simple prophylactic measure.

Sudden hemiplegia or even severe abdominal pain, as well as sciatica and other pains referred to nerves, may be due to a small neurofibroma of the spine, which in turn may be due to metastases from other areas, especially the lungs.

From "Metastases Medical and Surgical" by Malford W. Thewlis (Charlotte Medical Press).

Case Reports

HEALING OF PATHOLOGICAL FRACTURES THROUGH METASTASES FROM CARCINOMA OF THE BREAST

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BECAUSE of a case of carcinoma of the breast with multiple osseous metastases and eight pathological fractures, five of which were shown to have healed, a brief review of the literature and an abstract of this case was thought to be of value.

The importance of this problem is accentuated by recalling that of all carcinoma, breast cancer ranks third in order[1] and that in some series, the incidence of osseous metastases is 17.8 per cent,[2] and as high as 37 per cent[3] in others. Bone is the third commonest site for metastasis in breast carcinoma, osseous metastases appearing most frequently in the lumbar vertebrae and in the upper ends of the femora.[4] The histologic appearance of the primary tumor is not related to the extent of metastasis.[4]

It has been maintained by many that pathological fractures will not heal unless treated by *x*-ray, and by others that such fractures will not heal at all because of the presence of tumor tissue at the fracture site. Such views apparently have root in Grunert's statement[5] that "in true carcinomatous metastases, union of fragments can never occur." Bloodgood[6] and Codman[7] concurred with this later.

A dissenting view was held by Kohler[8] who reported several healed fractures through metastatic carcinoma. In 1936, Welch[9] reviewed the literature and reported fifty-three cases with sixty-six fractures (49 per cent of which were from breast carcinoma), stating that 5 per cent healed with firm union, 9 per cent showed moderate healing, and no evidence of healing was obtained in 80 per cent. In his series, the average length of life following fracture through carcinoma was less than six months.

The following case is that of a fifty year old white woman who suffered eight pathological fractures, the first four years and eight months after radical mastectomy for carcinoma of the breast. There has been no evidence of local or axillary recurrence, and the patient has subsequently had seven more fractures in a period of two and one-half years. Only one of these fractures was subjected to *x*-ray therapy and five have demonstrated both clinical and roentgenological evidence of firm union. Three have not been examined radiologically subsequent to fracture, although clinically two have united. One clavicle was still the site of pain and union did not seem complete. There was some question of re-fracture in this clavicle.

CASE REPORT

A. H. (No. 35200), a fifty year old white, married, Turkish-born woman, entered The New York Hospital for the first time on June 30, 1936, complaining of a painless lump in the right breast, first noticed one week before admission. Her past history was negative except for cholecystectomy in October, 1927. She had had no pregnancies. On July 1, 1936, right radical mastectomy was performed. The surgical pathological report was medullary and scirrhous carcinoma of the breast with axillary metastasis. The postoperative course was uneventful and the patient was discharged on the eleventh postoperative day.

The patient was re-admitted on March 15, 1941, complaining of pain in the left thigh of two weeks' duration. The day of admission the leg gave way beneath her while walking. Examination was unremarkable except for signs of fracture of the middle third of the left femur and *x*-ray examination revealed pathological fracture. In addition metastases were noted in the left ischium, pubis and ilium, fifth lumbar vertebra and sacrum.

Russell traction was maintained for one month and she was then placed in a hip spica for six weeks, when *x*-ray examination revealed callous formation. *X*-ray therapy (1,500 r) was given to the fracture site through a window in the cast. The patient was walking with the aid of crutches three months after the fracture had occurred.

From October 3, 1941, to November 3, 1941, the patient received *x*-ray therapy to the entire spine and pelvis. Scalp nodules were noted December 22, 1941, and skull plates revealed multiple osteolytic areas of metastasis. *X*-ray therapy was then given to the skull.

The patient was re-admitted July 10, 1942, complaining of pain in her head and spine of six months' duration. *X*-rays revealed further extension of metastasis with collapse of the ninth dorsal vertebra. Further *x*-ray therapy to the spine was instituted.

On February 6, 1943, the patient was admitted for the fourth time, complaining of pain in the right arm and left leg of four hours' duration, following a fall in the tub. *X*-ray showed pathological fractures of the right humerus and left femur. The patient was placed in traction for one month and then a hip spica and hanging cast were applied. On March 12, 1943, the left clavicle was fractured when the patient turned in bed and four days later the right clavicle was also fractured. On March 24, 1943, the casts were removed, *x*-rays showing good callous formation. She was discharged three days later in a wheel chair.

PHOSPHORUS, CALCIUM AND PHOSPHATASE DETERMINATIONS

	Serum Phosphorus	Serum Phosphatase	Serum Calcium	Acid Phosphatase
7/14/42	3.6	4.6		
9/13/43	4.1	10.5		6.3
9/15/43	4.3	11.3	10.6	

The patient was re-admitted on September 9, 1943, with a pathological fracture of the left humerus of twenty-four hours' duration. A hanging cast was applied and removed five weeks later, when *x*-rays revealed union. One week before removal of the arm cast, pathological fracture of the right femur occurred. The femur was immobilized in a hip spica which was left in place for five weeks and the patient discharged, *x*-rays showing good callous formation and clinically union was satisfactory.

SUMMARY

A case report is presented with eight pathological fractures, five of which definitely healed. The fractures occurred over five years after radical amputation of the breast for carcinoma. It is interesting to note that the union from the first pathological fracture of the femur was strong enough so that the patient was able to walk without difficulty. She later refractured this same femur, but not in the same place.

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INTRAPELVIC PROTRUSION OF THE ACETABULI

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INASMUCH as the etiology of intrapelvic protrusion is still a matter of discussion, this case is being reported because it is somewhat unique in that hip symptoms are completely absent except for pain in the right knee.

Since Otto's original description in 1824, Pomeranz[21] was able in 1933 to collect only forty-one acceptable cases. To these Rechtman[23] added fourteen cases from subsequent literature, plus five of his own cases in 1936. Although there have been more frequent reports in the later literature, the total acceptable cases number only around one hundred. Mayoral[17] states that he found only one case in 33,709 roentgenological examinations.

Intrapelvic protrusion has at various times been designated as Otto's pelvis, protrusion acetabuli, and arthrokatadysis, a term suggested by Verrall.[29] White,[31] in 1884, described the first case of intrapelvic protrusion we were able to discover in the English literature. Hertzler,[10] in 1922, reported the first case in this country. Kohler[12] credits Kienbock with making the first roentgenological observations. The Germans have written at length on this condition.

The greatest discussion in the literature has centered around the etiology, most authors agreeing, however, that this condition is not a disease entity. The question may be somewhat simplified by dividing the cases into three general categories:

1. Those deformities following trauma or metastatic processes. These should not be classified as examples of Otto's pelvis.

2. Cases following acute or chronic infections. Mayoral's[17] case report includes three *x*-rays, the first showing only an infectious arthritis, the second thirty-four months later, showing a fully developed protrusion, and a third *x*-ray eleven months later showing a quiescent lesion. The associated infections were a staphylococcic arthritis of the knee, an osteomyelitis of the femur, and a streptococcus infection of the ankle. As an amputation was performed for the bone disease, weight-bearing played no part in the development, and the mechanical force contributing to the deformity was attributed to muscle spasm. Sloane and Frauenthal[27] exhibit an interesting series of *x*-rays in the development of the protrusion, which they believed was the result of a Neisserian infection. The gonococcus is a favorite etiologic agent with many of the authors and is associated with too many cases to be entirely coincidental. Pomeranz,[21] who has an excellent summary of cases reported up to 1932, favors the infectious origin for all cases, and thinks that there are two types, (1) an acute type probably infectious in origin, and (2) a chronic type occurring in the course of any disease resulting in a localized osteomalacia of the acetabulum provided the femoral head maintains its boring qualities. He believes that this condition represents, "an atypical but essentially non-specific arthritis of the hip joint." Deformities following tuberculosis and echinococcus have been cited in the literature, but would seem to fall outside the scope of consideration.

3. The case reported here is typical of the third group and illustrates Doub's[3] theory of a general disease in early life causing a softening of the bones with a resulting deformity, the osteo-arthritis representing a later stage in the process. Pomeranz[21] states that Eppinger was the first to suggest that a disturbance of acetabular development is responsible for the condition. Rechtman[23] believes that "the prime factor is a pre-existing deep acetabulum" and that "the many etiological

factors suggested (formerly) were therefore probably only the irritating agents acting on an area of potential weakness." Gilmour[6] in an extensive discussion, believes that the primary disorder is "a premature acceleration of primary epiphyseal ossification" whereby the epiphyses are converted into young vascular bone which is ill adapted to resist strain and thus accounts for the bilateral occurrence, and the more frequent occurrence in females. He states that there is a concomitant slight coxa vara, and thinks that the osteo-arthritis is due to the result of a capsular shortening and a disturbance of the fluid mechanism of the joint. In the opinion of Gilmour, the uncomplicated deformity remains painless until degenerative or irritative changes occur. Maldevelopment of the acetabulum in one direction results in a shallow acetabulum with dislocation, and maldevelopment in the other direction in a deep acetabulum. In line with this theory, two of Rechtman's[23] cases suggest a familial factor, and Gickler[5] has written an article entitled, "Familial Occurrence of Protrusio Acetabuli; Etiology."

Symptoms. Our own patient was symptomless except for pain in one knee. Many authors believe that, aside from the acute infectious cases, intrapelvic protrusion is frequently asymptomatic until osteo-arthritis occurs, or until trauma or infection calls attention to the condition. The symptoms are those of arthritis and of the mechanical limitation of motion. Several cases are on record of the deep acetabuli complicating parturition.

Physical Findings. The most constant physical findings are limitation of motion, particularly in abduction and external rotation. There is a rather constant flexion deformity with a compensatory lordosis. Gilmour[6] has called attention to the alterations in the pelvic measurements and says that the intertuberous diameter is always less than normal. He also states that there is an increase in the intercristal diameter with a relative reduction in the bitrochanteric diameter. Some observers have been able to feel the protruding acetabuli through the abdominal wall and on rectal examination. We believe this was possible in our case.

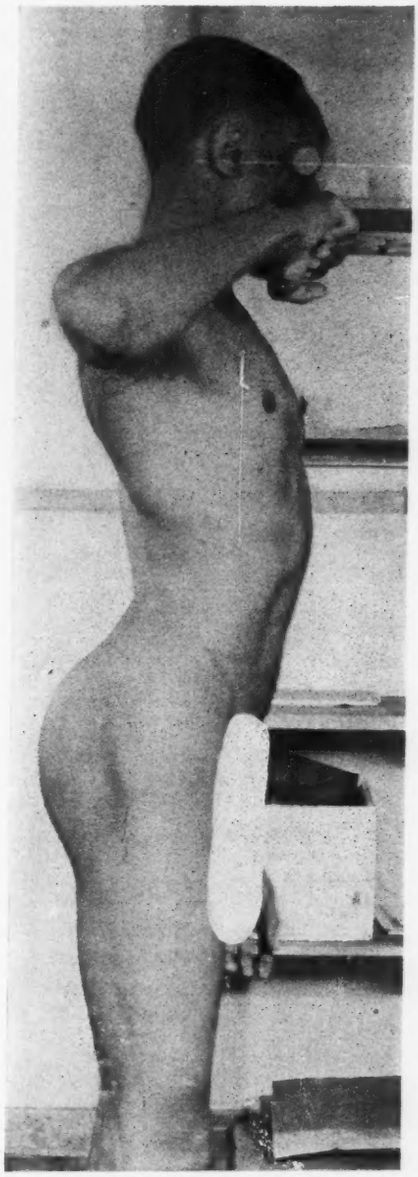

Fig. 1. Lateral view showing flexion of lower extremities and compensatory lordosis.

X-ray Findings. These have been repeatedly described in the literature and are noted in detail in the case report given below.

Therapy. Therapy is unsatisfactory; diathermy, radiant heat, massage, traction, salicylates, plaster casts, arthroplasty

and arthrodesis have all been used. (Figs. 1 and 2.)

CASE REPORT

The patient, admitted to Oliver General Hospital on June 27, 1944, a colored male, twenty-five years of age, first sought medical attention in July, 1943, for pain and stiffness in the knees following prolonged marching. He received heat treatments for one month with no improvement. *X*-rays of the knees taken at that time were said to be negative. The symptoms were relieved after he was assigned to the ligher duties of truck driving, and for about six months thereafter he was symptom free. He next sought medical attention in April, 1944, when pain in both knees was noted with some "cramping in knee," more pronounced on the right side. *X*-rays of the hip joint revealed a moderate protrusio acetabuli. He first came under our care June 27, 1944. At no time had there been any complaint of pain in the hips. The only symptom was that of aching discomfort beneath the patella.

The patient denied serious illnesses or injury. There was no history of knee injury. He had gonorrhea in 1934 and was treated by pills and injections and declared "cured" in less than ten days. Another attack of gonorrhea in 1943 was treated with sulfonamides. The discharge lasted only three or four days.

FIG. 2. *X*-rays showing bilateral intrapelvic protrusion.

The positive physical findings were as follows: Height 5 feet 5 inches; weight 152 pounds; pupils: round, regular, equal; reacted sluggishly to light; nose: irregularly deviated septum, non-obstructive, mucosa thickened and moderately injected. throat: tonsils hypertrophied and chronically inflamed; pulse 72; blood pressure 116/70. hernia: slight dilatation of the left ring with a transmitted impulse on coughing; abdominal: on deep palpation in the left lower quadrant, the acetabulum was barely palpable; genito-urinary: slight thickening of the right epididymis. The prostate was normal in size, not tender, and a very slight quantity of secretion was expressed on massage. The first and second glasses of urine were clear. On rectal examination, the acetabular protrusion on the left side could be made out.

Reflexes: the right knee jerk is less pronounced than the left. The Achilles tendon reflex was more pronounced on the right side.

In the standing position, there was marked lumbar lordosis. He walked guardedly with a limp to the right and avoided putting his weight on his right lower extremity. As he walked, the marked lumbar lordosis was maintained. All motion of the dorsolumbar spine was free. In supine position on the examining table, the patient kept both knees flexed. When the lumbar spine was flattened by flexing the left hip, there was a flexion deformity of 40 degrees and 15 degree abduction of the right hip. When the right hip was flexed, there was a flexion deformity of 40 degrees on the left side, and the limb was held in neutral position. Flexion of the hips was possible to an angle of 60 degrees on the right side and 85 degrees on the left. Internal and external rotation was completely restricted. Abduction was restricted on both sides. Motion of the knees was free and normal, but on the examining table, the patient was unable to extend the knees completely on account of the flexion deformity of the hips. On the right side, extension was maintained at an angle of 170 degrees, and 160 degrees on the left. Motion of the ankle joints and metatarsophalangeal joints was free. Circumference of the right thigh six inches above mid-patella was 17½ inches; left thigh the same. Motion of the joints of both upper extremities was free. There was no evidence of arthritis.

X-ray findings of the right knee and sinuses were negative. Both acetabula were quite deep and the floor was quite thin and consisted of a shell-like bone which protruded into the pelvis. The joint space of each hip was markedly reduced, and there was evidence of marked hypertrophic changes along the margins of the joint with some flattening of the head of each femur where it joined the neck. The lower portion of the spine and the sacroiliac joints were normal in appearance. This is typical of protrusio acetabuli.

Chest *x*-ray showed the trachea in the midline. Heart and great vessels were within normal limits. Apices and costrophrenic angles were clear and the lung fields were normal. The thoracic cage revealed nothing abnormal. The right wrist was normal, except for a separate center of ossification of the styloid process of the ulna, which had not fused. The left wrist was normal as were also the hands.

Laboratory Data: Blood count: red blood cells 4,880,000. hemoglobin 104 (Sahli). white blood cells 6,150. differential: polymorphonuclears 60 per cent, eosinophiles 4 per cent, lymphocytes 36 per cent. Urinalysis: color, straw; cloudy; reaction, acid; albumen, negative; sugar, negative; microscopic 10 to 18 white blood cells to high power field; sedimentation rate: 4 mm. in one hour. Culture for gonococci (prostatic secretion): negative; blood chemistry: calcium 12.5 mg. per cent; phosphorus 4.4 mg. per cent; phosphatase 5 units. Tuberculin test: negative. No parasites or ova were found in the stool.

Comment. The case herein reported presents the classical picture of intrapelvic protrusion. It is unusual in that there were no symptoms referable to the hip other than knee pain on one side. Physical examination and *x*-ray of the knees revealed no evidence of knee disorder, nor were osteo-arthritic changes demonstrable in other locations. Some of the theories of etiology have been cited and correlated. We have no new suggestions as to etiology.

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INFECTED URACHAL CYSTS

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CYSTS resulting from a patent urachus are a relatively rare condition, are frequently undiagnosed and usually give rise to no symptoms unless they become infected.

Embryology. Dreyfuss[1] describes the urachus in post-embryonic life as representing an involuted structure. Originally, it was a part of the fetal bladder. The bladder is formed, except for the trigone and the region of the ureteral openings, by a division of the common cavity of the cloaca by a septum forming the posteriorly located rectum and the anteriorly located bladder. The primitive cloacal epithelium becomes modified to meet the physiologic purposes of the final organ. The fetal bladder extends up to the umbilicus where it continues into the allantoic stalk which also carries the umbilical vessels and is better known as the umbilical cord. Eventually, the upper half of the bladder narrows, the lower half retires behind the protective barrier of the pubic bone and all that remains of the upper half is a duct-like structure, the urachus.

Anatomy. Lowsley and Kirwin[2] state that in the normal adult, the urachus reaches only one-third of the distance from its point of attachment at the apex of the bladder to the umbilicus and is attached to the posterior aspect of the navel by the fibrous remnants of the obliterated hypogastric arteries. Begg[3] states that the urachal epithelial canal is never completely obliterated by fibrous tissue but retains a bore of 1 mm. Lowsley and Kirwin[2] add that ordinarily, however, this small channel is completely obstructed at birth by proliferated and shed epithelial cells and débris which accounts for the rarity with which urine is found to pass upward from the bladder. The epithelial cells tend to proliferate outward into the dense connective tissue layer which surrounds and supports the lining membrane of the normal urachus.

Pathology. Lowsley and Kirwin[2] state that in approximately two out of three persons, the lumen of the urachus is separated from the bladder proper by a transverse mucous fold but in the third instance, this partition fails to develop, the lumen remining completely or partially patent and what is known clinically as persistent or patent urachus occurs. Acquired abnormalities are the result of urinary obstruction either with or without some defect of development.

When the urachus remains patent, it may assume any one of four variations according to Long:[4] (1) *Complete type:* This consists of the urachus communicating with the bladder and umbilicus. (2) *Blind external type:* In this type, the urachus communicates with the umbilicus. (3) *Blind internal type:* This may be described as failure of obliteration at the bladder. (4) *Totally blind type:* Obliteration, in this type, takes place at the umbilicus and the bladder but patency occurs at some point between the two.

To these, Lowsley and Kirwin[2] add a fifth condition, vesico-umbilical fistula in a fetal type bladder, one that fails to descend.

The blind external type may produce a mucoid or mucopurulent discharge and later a granuloma. The blind internal type may persist unrecognized through life. However, when associated with obstruction of the lower urinary tract, it may result in a diverticulum. Lowsley and Kirwin[2] comment that infection with discharge into the bladder will account for some cases of recalcitrant cystitis and

pyruia. In the presence of lower tract obstruction or increased intravesical pressure, urine escaping into an open terminal urachal canal may extravasate to the umbilicus thus to be discharged at the external surface converting the external blind canal into a completely patent urachus. These acquired patent canals are confirmed in the literature with congenital patent urachus.

Some of the complications of patent urachus are exstrophy of the bladder, tumors benign or malignant, cysts, abscesses, cavities between the bladder and umbilicus, calculi and tuberculosis. We are concerned in this article mainly with urachal cysts.

Incidence of Patent Urachus. Patent urachus is a comparatively rare condition. Herbst,[5] in 1937, stated that a careful review of the literature disclosed 148 cases in the previous four centuries. Dudgeon,[6] in 1938, stated that only about 150 cases had been reported since 1550. The same writer,[7] in 1940, stated that there were 154 such cases reported up to 1936 to which he now added seven and that male cases exceeded female in a ratio of about two to one.

Mahoney[8] found a patent urachus three times in a total of 200,000 admissions to the Children's and Infant's Hospital in Boston. Campbell[9] reports fifteen such cases in 12,080 autopsies on children. Bandler and associates[10] found that in over 100,000 admissions to the New York Post-Graduate Hospital only three cases of patent urachus were found. Herbst[5] states that the earliest case in the literature was the one reported by Cabral in 1550.

URACHAL CYSTS

General Description. Dreyfuss[1] states that probably most of the urachal cysts are retention cysts. Half of them are found close to the bladder into which some of them open. They sometimes attain tremendous size and the largest one that has been described contained many liters of urine-like fluid. Yoerg[11] states that while urachal cysts are uncommon, the condition probably occurs more often than the small number of cases reported would indicate. Cross,[12] in 1935, found only ninety-six cases reported. Lowsley and Kirwin[2] assert that such cysts may form at any point between the apex of the bladder and the umbilicus if a small portion of the duct remains patent. The majority (over 50 per cent) are found at the vesical end. Bauer[13] makes the statement that they may contain urine, a mucoid fluid from the cyst wall, a serous transudate, pus, cholesterin, fat cells, epithelium or fibrin. Dreyfuss[1] includes blood and rarely concretions in his description.

Infection is present in practically all cysts that come to operation. Escherichia coli, streptococci and staphylococci have been reported. Many show no bacteria by smear or culture. Many observers believe that the entrance of bacteria is by way of the lymphatics or blood stream. Kantor,[14] while admitting that this possibility cannot be denied adds: "However, with previous communication with the bladder demonstrated, direct extension seems plausible in most cases. The tract may not be demonstrated because of subsequent obliteration." In regard to sterile cultures, he adds: "This is in accord with localized infection elsewhere which after a period of time may become sterile."

Etiology. Yoerg[11] makes the assertion that there is no agreement as to etiology. Some believe that the lacunae of Luschka enlarge to form cysts. Yoerg thinks, however, that it would hardly seem possible that these minute cavities could enlarge without a secreting lining. Although the bladder epithelium does not have a secreting function, it is of course possible that the epithelial lining may have changed its function to become secreting. An obstruction of the urine flow would account for the completely patent cyst but could not produce the internal blind cyst which is by far the commonest type.

Symptoms and Physical Signs. An uninfected urachal cyst gives rise to no

symptoms. An infected cyst will give rise to the general symptoms and physical signs of infection. A tender suprapubic mass, abdominal pain, tenderness, gastrointestinal symptoms, fever and leucocytosis often occur. Dysuria will occur if the cyst connects with the bladder and pyuria frequently accompanies this. A purulent or mucopurulent discharge from the umbilicus usually means the umbilical type of cyst. The diagnosis of urachal cyst is not easy. Rankin and Parker[15] maintain that relief is obtained by forward stooping and aggravation is obtained by deep breathing. Archibald[16] asserts that urachal cysts of moderate size are palpable below the umbilicus, sometimes to one side of the mid line, as rounded tumors often moving more freely from side to side than up and down and that movement of the tumor from side to side may produce an indrawing of the umbilicus. Other investigators have shown that those cysts that connect with the bladder can be demonstrated by cystoscopy and cystograms. Gastrointestinal symptoms may mean that perforation into the peritoneal cavity is imminent.

Treatment. The treatment of infected urachal cyst is purely surgical. Incision and drainage should be promptly performed. Lowsley and Kirwin[2] maintain that this should be followed by radical excision at a later date. Dreyfuss[1] likewise states that it may be necessary first to drain and to remove the cyst later as a secondary operation. He adds that an unfortunate complication would be perforation into the peritoneal cavity. Yoerg[11] asserts that in some cases the cysts can be removed completely without entering the peritoneal cavity. However, if infection is present, the cyst will usually be firmly adherent to the peritoneum and a conservative procedure is advisable, consisting of incision, curettage and free drainage. It appears that many of these infected cysts so treated will heal permanently. If, however, the sinus should persist, excision of the cyst can be done more safely later in the absence of acute infection for it is usually necessary to enter the abdominal cavity to facilitate removal. In patent urachus connecting with the bladder, it is obvious that removal is necessary and that the opening in the bladder be closed.

Review of the Literature. The first clear picture of urachal cyst in the literature is found in an article published in 1886 by Lawson Tait[17] who reported twelve cases. Tait was also the first to have made a correct diagnosis preoperatively. However, Tait was preceded by some other surgeons as reported by Weiser[18] who, in 1906, made an extensive review of the literature of urachal cysts and collected eighty-six cases to which he added three of his own. In the eighty-six cases, nine were completely patent, seven externally blind, eight internally blind, forty-six blind at both ends and sixteen could not be classified. The first reports were by Hoffman (1870), Wolff (1873) and Atlee (1873). Wutz (1883) analyzed all alleged cases diagnosed clinically or at autopsy and said that most of them had been misdiagnosed or had questionable symptoms and he believed that there were definitely no clinically important urachal cysts up to that time. Weiser[18] asserts that much of the history in the eighty-six cases up to 1906 was meager and questionable. In the eighty-six cases, twenty-one were males, fifty-eight females and seven not stated. Weiser made the deduction that urachal cysts are most common in middle life for half of the cases in which the age was given occurred between twenty and forty years of age. He also deduced that such cysts occurred more often in females than in males. Weiser's own three cases were all large cysts, two in females and one in a male. Complete removal was performed with recovery. Doran,[19] in 1909, reported a case of urachal cyst simulating appendicular abscess and in his summary of the literature agreed with Wutz that up to 1883 no clinically important cysts were reported.

Pendl,[20] in 1914, reported a colloid carcinoma arising from a urachal cyst and cites Schwartz as having been the first to

have reported such a case (1912). De Waard[21] reported two similar cases in 1939 and Hughes and La Towsky[22] likewise reported two such cases (1942). Long[23] (1927) reported a dermoid cyst developing in a patent urachus and stated that such cases are rare and that he could find but six such cases previously reported. Hamm[24] (1940) reported a benign cystadenoma of the bladder probably of urachal origin.

Padovoni and Dufour,[25] in 1930, reported two cases of urachal cyst connecting with the umbilicus. One was resected and the other merely drained. They warned against resection as risking the danger of contaminating the peritoneal cavity with infected cyst contents.

Archibald[16] (1930) described a case of urachal cyst in a twenty-six-year old male. The symptoms resembled those of acute appendicitis. Resection was performed. The author claimed that resection can usually be performed without opening into the peritoneal cavity except when there are extensive adhesions.

Lubash[26] (1929) reported a case of a twenty-two-year old male with a urachal cyst connecting with the umbilicus. Resection was performed with recovery.

Schmidt[27] (1933) reported three cases of urachal malformations, one of a fetal type bladder with umbilical fistula in a four-year old boy upon whom he performed a resection of a conical section of the bladder; one small cyst with concretions in an eight-year old girl in which case the operation was resection, and one large cyst in a twenty-four-year old man which was resected.

Stevens[28] (1933) described a purulent urachal cyst connected with the umbilicus in a twenty-four-year old male which was resected and Douglass[29] (1933) reported two cases, one an infected urachal cyst in a woman of fifty-one which was drained and one case of urachal fistula discharging exteriorly and connecting with the bladder in a woman of thirty-two.

Cross,[12] in 1935, reviewed the literature comprising ninety-six cases of urachal cysts and added one of his own which ruptued into the abdominal wall. Only one of the ninety-six cases reviewed took such a course although some ruptured into the bladder, the peritoneal cavity or externally through the umbilicus. In Cross's case, a fistulous tract leading to the bladder was found, packed and left wide open with complete recovery.

Gayet and Verrière[30] (1936) described a case of a sixty-nine year old man with a pedunculated urachal cyst, the pedicle being attached to the bladder. The cyst was resected, a portion of the bladder near the pedicle was also resected and the wound drained.

Dudgeon[6] (1938) reported five cases of urachal cysts four of which were resected and one large abscess of the urachus merely drained. All of the patients recovered.

Kantor[14] (1939) reviewed thirty-six cases of urachal cyst in the literature and added two of his own. One was in a two-year old female which was drained. The other was in a twenty-nine-year old male which was drained and was resected at a subsequent operation. Kantor made the statement: "It is suggested that where the diagnosis of infected urachus cyst is made, incision and drainage may be adequate to effect a cure. Where reoperation may be necessary, subsequent excision is more easily and safely performed."

Dudgeon[7] (1940) reported seven cases of patent urachus, six of which had cysts and gave a review of the 154 cases of patent urachus reported up to 1936. His summary of the 154 cases is as follows: 107 or 69.6 per cent recovered; thirteen or 8.4 per cent died; twenty-eight or 18.1 per cent were not cured; in six or 3.9 per cent the result was not reported. Of the 154 cases, seventy occurred in children under thirteen years of age. Of Dudgeon's seven cases of patent urachus, five had small infected cysts which were removed. One had a large urachal abscess which was drained. The six patients who were operated upon were all cured. The other patient refused operation.

Dreyfuss and Fliess[31] (1941) give an account of patent urachus with stone. Bandler and associates[10] (1942) likewise describe urachal calculi with a complete review of the literature of patent urachus.

Everett[32] (1942) described a case of peritonitis due to perforation of an infected urachal cyst. This was resected with drainage followed by recovery.

Yoerg[11] (1942) gave a very complete account of urachal cysts and a review of the literature. He described one new case of urachal cyst which connected with the umbilicus. Curetting the cavity followed by the application of 20 per cent silver nitrate cured the condition.

Powers[33] (1942) gave a good account of various suppurative processes of patent urachus.

Winer and Danciger[34] (1941) described tuberculous involvement of patent urachus.

Perez and Matera[35] (1942) reported a case of suppurating cyst of the urachus. Treatment was drainage and recovery resulted.

Fisher[36] (1942) reported the case of an infected urachal cyst in a four-month old female. Excision was performed with a postoperative sinus following.

Evans[37] (1942) reported a case of infected urachal cyst in a twenty-eight-year old male. Complete excision was performed with recovery.

CASE REPORT

X, a male infant, aged seven weeks, was first admitted to Israel Zion Hospital, April 20, 1943. Severe upper respiratory infection had occurred two weeks before onset.

His present illness began two days prior to admission. The symptoms consisted of acute urinary retention secondary to phimosis, the latter being treated by means of a dorsal slit. Simultaneously with the symptoms noted, three furuncles were found upon the lower abdominal wall. These were incised, each discharging a considerable amount of pus.

A suprapubic mass which had been noted at the time of the dorsal slit operation failed to disappear following catheterization; on the contrary, it progressively increased in size during the next two days and became more tender and fluctuating.

Under general anesthesia, a median subumbilical incision one inch in length was made and 750 cc. of thick yellow pus evacuated. Two Gm. of sulfanilamide crystals were placed within the abscess cavity, a Penrose drain inserted and the cavity packed with two strips of iodoform gauze.

The postoperative course was uneventful. Sulfathiazole was administered orally for the next three days. The temperature returned to normal and the patient sent home on the seventh postoperative day.

Laboratory findings were as follows: Urine: Free from albumin, sugar and acetone; an occasional leucocyte and epithelial cell. Blood count: White cells 29,200; 64 per cent polymorphonuclear leucocytes, 36 per cent lymphocytes. The subsequent count postoperatively was 17,800 white cells with 62 per cent polymorphonuclear leucocytes, 4,120,000 red cells and 84 per cent hemoglobin.

Examination on May 16, 1943, revealed the wound to be completely healed with no further drainage. Two weeks later, a suprapubic swelling again appeared in the region of the operative scar. In two days, this mass increased in size rapidly and became tender and fluctuating. The temperature was 101.8°F.

On June 5th, the suprapubic scar was elevated and pus was visible beneath it. Pressure upon the suprapubic mass was followed by a purulent discharge from the umbilicus. A probe was inserted into the umbilicus caudad for a distance of 2 cm. Upon removal, purulent material was detected on the probe. A diagnosis of infected urachal cyst was made and the child again hospitalized.

At the second operation, under general anesthesia, an incision was made through the previous scar and 350 cc. of a thick yellowish green pus evacuated. The abscess cavity was explored digitally and found to be extraperitoneal but extending posteriorly to the left as far as the left lateral aspect of the mesosigmoid; 4 Gm. of sulfanilamide crystals were placed in the abscess cavity and the cavity was again packed with iodoform gauze.

Culture of the purulent fluid revealed Streptococcus fecalis, Escherichia coli and Bacillus bifidus.

The postoperative course was uneventful. The patient was discharged upon the seventh

day. The wound continued to drain until July 15th, followed by complete healing. The general condition of the infant has remained excellent since and there have been no further recurrences.

SUMMARY AND CONCLUSIONS

1. The anatomy, etiology and pathology of urachal cysts have been described.

2. Urachal cysts are relatively rare and follow a patent urachus. Such cysts cause no symptoms unless they become infected.

3. The symptoms of infected urachal cysts have been described and are the local and general symptoms of infection.

4. The treatment is surgical. Incision and drainage are usually sufficient. A few cases require resection. This is best postponed until a later date on account of the danger of peritonitis if it is performed at the original operation.

5. A case report is given in which incision and drainage of an infected urachal cyst was performed but had to be repeated once. Full recovery resulted.

6. A review of the literature has been added.

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SQUAMOUS CELL CARCINOMA OF THE RENAL PELVIS*

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THE incidence of non-papillary, squamous cell carcinoma of the renal pelvis is very low. The papillary neoplasms comprise the largest number of carcinoma of the pelvis of the kidney. In 1933 Swift-Joly collected 337 tumors of the renal pelvis from the literature and classified fifty of these as the non-papillary, squamous cell type. Additional cases have been reported by Scholl, MacMillan and Gilbert, Silverstone, Nicholson, and Priestly. In 1939, Higgins reported five cases and reviewed fifty-nine cases from the literature. Melicow, in 1944, in a review of the renal tumors encountered at the Squier Urological Clinic, reported thirteen cases of this type of lesion, a total of seventy-seven cases.

This unusual clinical and pathological entity needs emphasis in view of the viciousness of its local extension and metastatic spread, the extreme difficulty of preoperative diagnosis, and because of its frequent association with renal calculi and chronic kidney infection. The medical profession has long been cognizant of the deleterious effects of calculi on the kidney as on their heels interference with the normal outflow of urine, secondary infection, and progressive destruction of the renal parenchyma inevitably follow, but a fact not so readily appreciated is that an almost 100 per cent fatal sequella may at times be the development of malignant disease within the kidney. It is accepted by both pathologists and urologists that a small, but definite, group of renal tumors—the so-called non-papillary, squamous cell carcinoma of the renal pelvis—are etiologically related and associated with calculous disease of the kidney. The high malignancy of this type of growth was emphasized by Higgins who was unable to find a single case from the literature in which the patient was free from metastasis five years after operation. The immediate mortality has also been exceptionally high. It is a neoplasm which rapidly causes death. Early diagnosis is extremely difficult and very unusual, as there is no clinical syndrome by which a positive diagnosis can be made. The co-existence of calculi, renal infection, or both may direct the attention of the attending surgeon away from the possibility of tumor except in an occasional instance in which urographic study may delineate a characteristic filling defect in the renal pelvis. The diagnosis is most frequently made at the time of operation or by the pathologist.

Kretschmer, in 1917, stated that the weight of evidence pointed to chronic inflammation resulting from renal calculi or infection playing the major rôle in the development of this type of cancer. As a result of longstanding irritation the normal epithelium of the renal pelvis, which has been referred to as transitional in type, undergoes metaplasia and develops stratified squamous epithelium and subsequently varying degrees of leucoplakia. Malignant degeneration later takes place. A characteristic feature of the squamous cell neoplasm is that the tumor cells have kerotinized and produce prickle cells, or so-called pearly and onion bodies. As distinguished from the papillary carcinoma of the renal pelvis these growths extend by direct invasion of the kidney proper, peri-

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renal tissues and local lymphatics, as well as by early distant metastasis to the liver, lungs and long bones. The papillary neoplasms spread by transplantation of tumor cells along the ureter. Implants in the bladder, proximate to the ureteral orifice of the involved side, may at times be noted. Obviously, therefore, in view of the different life habit of these tumors, the surgical management differs. Ordinary nephrectomy with removal of the proximal ureter suffices for the non-papillary type, while nephroureterectomy with segmental resection of the intramural portion of the bladder is the ideal method for the papillary lesions.

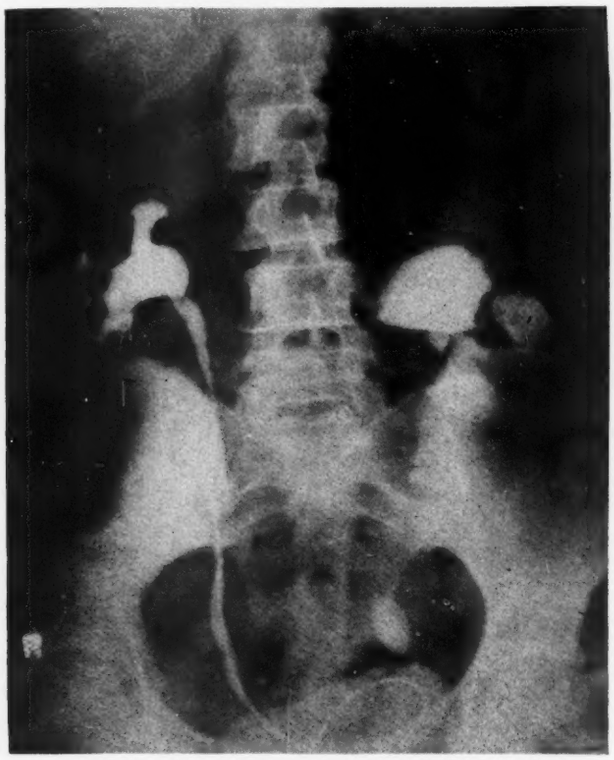

FIG. 1. *X*-ray plate showing multiple giant calculi of the left kidney and a large calculus in the lower left ureter.

CASE REPORT

Case No. C-59223, St. Elizabeth's Hospital: A woman, aged fifty-eight years, was admitted to the hospital on March 19, 1944, complaining of pain and the presence of a large lump in the left upper quadrant, of several months' duration. There were no symptoms referable to the urinary tract. She had experienced no urinary frequency, urgency, or painful urination, and as far as she was aware she had passed no blood in the urine. There had been some loss of weight which she attributed to worry over her boys in the Service. There was loss of appetite and she felt nauseated at times. The past history revealed no serious illnesses. The family history was irrelevant. She had had nine children, all of whom were living and well.

Physical examination revealed a grey-haired woman who appeared much older than her given age. Her appearance suggested the recent loss of weight. There was some pallor. The tongue was moist. There was a large, irregular, firm, slightly tender mass in the left quadrant, extending from the costal margin to just above the level of the anterior superior spine. It was believed to move on respiration. The right renal region was negative. On pelvic examination there was a healed laceration of the cervix and no masses could be felt in the vaults.

Laboratory findings: Blood: hemoglobin 68 per cent, white blood cells 9650, red blood cells 3,370,000.

Smear large polymorphonuclear cells 79, lymphocytes 21. Nonprotein nitrogen—26 mg. per 100 cc. of blood. Urine: Yellow, acid,

specific gravity 1010, albumin slight possible trace; sugar, none. Sediment: very many white blood cells, occasional epithelial cells. Culture: Bacillus coli. Right kidney urine: Sediment—a few epithelial cells. Culture: Bacillus coli. Phenolsulphonphthalein two-hour renal injection test: 5, 30, 13 and 5; total 53 per cent.

Cystoscopy revealed no urethral obstruction. The bladder tone, tolerance and capacity were normal. The mucosa was considerably injected throughout. There was a slight elevation of the trigone. The ureteral openings were normal. A No. 5 and a No. 4 F. ureteral catheter encountered impassable obstruction 2 cm. above the left orifice. A No. 5 F catheter was passed readily along the right ureter. A plain *x*-ray of the kidney, urethra and bladder revealed the presence of a peach-stone shaped shadow, consistent with calculus, in the lower left ureteral region and multiple large shadows in the region of the left kidney. The left renal shadow was enlarged. (Fig. 1.) An attempt to obtain a left ureteropyelogram was unsuccessful. A right ureteropyelogram revealed the ureter moderately dilated in the upper third, with some dilatation of the pelvis and calices. The kidney was in second degree ptosis.

A diagnosis of calculus, ureteral, left, and calculus pyonephrosis, left, was made. A general medical program, directed to the improvement of her general medical condition, was carried out, following which nephrectomy was performed.

Transperitoneal nephrectomy was done. The

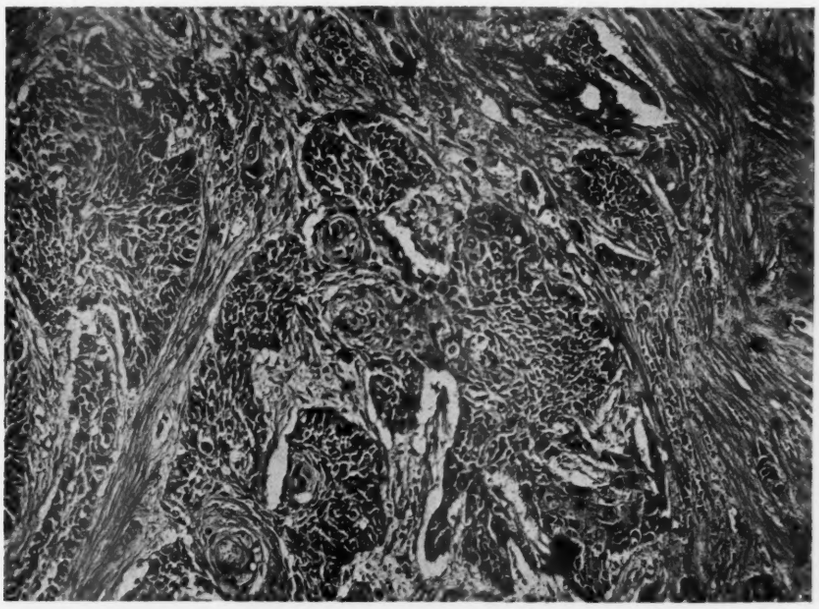

Fig. 2. Microphotograph showing epithelial pearls and intercellular bridges.

operative field was prepared with metaphen and alcohol. A left rectus paramedian incision was made, extending from the costal margin to just above the level of the anterior, superior spine through skin and fascia. The peritoneum was entered and a transverse incision carried laterally just above the level of the umbilicus. Palpation of the abdominal cavity revealed the presence of a large, firm, somewhat irregular, fixed, retroperitoneal mass. The bowel was reflected medially. The posterior peritoneum was adherent to the mass as was the pancreas, bowel, left ovary and the surrounding tissues. After considerable difficulty the adherent organs were separated from the tumor. The renal pedicle was then isolated, clamped, cut and the vessels were tied. The tumor was then freed from its bed. The ureter was markedly enlarged and was separated distally as far as possible, at which point it was clamped, cut and tied. The kidney and perirenal fat were then removed *en bloc*. It was necessary to remove the left ovary. Considerable bleeding was encountered and a lot of generalized oozing which was finally controlled. Two cigarette drains were left in the sound and brought out at the posterior angle of the lateral incision. The wound was closed with No. 1 chromic catgut and figure-of-eight stay

sutures. The sponge count was declared correct. The patient was given a blood transfusion during the operation and left the operating room in fair condition.

Pathological report: Received the left kidney with surrounding perinephric fat forming a large mass 23 by 19 by 11 cm. The kidney, 16 by 10 by 9 cm. is shelled out with great difficulty. The kidney is converted into a multilocular sac with large coral calculi filling many of the dilated calices. Only the shell of the cortex can be demonstrated. The pelvis is filled by a solid mass of tumor, pale, yellowish, and showing multiple focal areas of necrosis. The ureter is markedly dilated and thickened and has an average diameter of 3 cm. There is a purulent exudate throughout the pelvis and dilated calices. The perirenal fat is markedly thickened and there is direct extension of tumor from the pelvis. The average thickness is 3 to 4 cm.

Tissue from the pelvis shows invading neoplasm composed of masses of epithelial cells of the squamous type. Many onion bodies are demonstrated. Cells in places are necrotic, but those which stain well are fairly well differentiated and show deeply staining nuclei with occasional mitosis. Specimen from perirenal fat shows direct invasion by neoplasm. Tissue from lymphatic nodes shows similar invasion.

Diagnosis: Squamous cell carcinoma of renal pelvis with continuity extension to perirenal fat and surrounding lymph nodes; calculus pyelonephritis.

Postoperatively the patient's immediate condition was very satisfactory. There was some swelling and discoloration of the left lower extremity and it was believed that there had been some interference with the circulation due to manipulation of the blood vessels of the pelvis. The extremity gradually improved, although she experienced considerable pain. Eight days after operation she suddenly developed severe dyspnea and chest pain and expired. No postmortem examination was obtained. It was believed that the terminal picture was due to a pulmonary embolus.

CONCLUSION

Non-papillary, squamous cell carcinoma of the renal pelvis is concisely discussed.

Its association with calculus disease of the kidney is emphasized. The medical profession should keep in mind the possibility of malignant disease within the kidney when renal calculi and infection are encountered in later life.

A case of non-papillary, squamous cell carcinoma of the renal pelvis associated with giant calculi of the kidney is presented.

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MEGACOLON*

WITH A BRIEF REVIEW OF ETIOLOGICAL FACTORS AND TREATMENT

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THE etiology of megacolon or Hirschsprung's disease has been frequently discussed but to date no completely satisfactory solution has been found. To find the proper theoretical background in dealing with this problem is not only of academic value but is of great practical importance. The etiology should determine the type of treatment to be chosen.

There are two main schools of thought, one teaching that megacolon is a sequence of some type of congenital obstruction, the other declaring that it is based on a congenital anomalous development. The first group supports its theory by the findings of torsion of sigmoid, atresia of the anal canal, rectum or sigmoid, partial imperforate anus, hypertrophied rectal valves, etc. The second group believes that Hirschsprung's disease is congenital in origin with congenital hypertrophy and dilatation of the affected part of the colon, and classifies all cases of acquired megacolon as secondary or pseudomegacolon.

Many such cases of megacolon were reported to have originated during the first few days after birth and some during late fetal life. However, other patients with congenital obstructive anomalies such as imperforate anus, anorectal strictures and the like, did not show signs of megacolon.

The present belief is that true megacolon or Hirschsprung's disease is congenital and neurogenic in origin. It is a "dysfunction of the neuromuscular mechanism" (Adson) with either a hyperactivity of the sympathetic nervous system or a hypoactivity of the parasympathetic system.

The primary cause of this "dysfunction" or "neuromuscular incoordination," as called by Wade, has never been satisfactorily explained by any of these who have written on this subject.

The circular muscle fibers of the rectum are innervated by the sympathicus which, according to Hunter and Royle, is the causative factor for contraction of the sphincter and the maintaining of its normal tonus. Any irritating lesion of the sympathicus, peripheral or central, this means postganglionic or preganglionic, may cause a spastic condition of the rectal sphincter with failure to relax (Hurst, Fraser) and thus creates a basis for the development of megacolon.

After considering the above mentioned theories explaining the etiology of megacolon, we will be able to understand the different types of treatment advised and used for this condition. The medical treatment of megacolon as shown by a review of the literature, is not nearly so effective as the surgical, and probably should be reserved for use in very mild cases or as a preoperative preparatory procedure.

In the following recent statistical review of the literature in connection with 512 cases of megacolon, reported by Duval, Lowenstein, Terry, Neugebauer, Ladd, Judd, Adson, Wade, Royle and Rankin, the relation between medical and surgical treatment is clearly brought out.

* From the Department of Surgery, Charleston General Hospital. This case is being reported for the following reasons: (1) A very close and thorough study and follow-up for a considerable length of time could be carried out; (2) in reviewing the literature the authors found only comparatively few cases of megacolon reported, treated by sympathectomy.

In the report of 252 patients treated medically, the mortality ranged from 66 to 98 per cent with cures ranging from 2 to 12 per cent. Two hundred thirty-eight patients treated surgically (including all operative procedures other than sympathectomy) reveal a mortality of 26 to 48 per cent and a cure rate of 34 to 74 per cent.

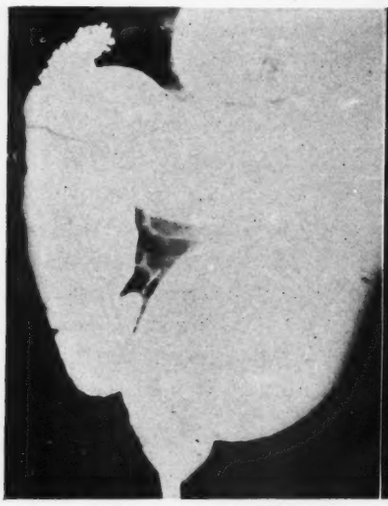


Fig. 1. Barium enema on September 30, 1942, reveals dilatation of the transverse, descending and sigmoid colon due to a megacolon.

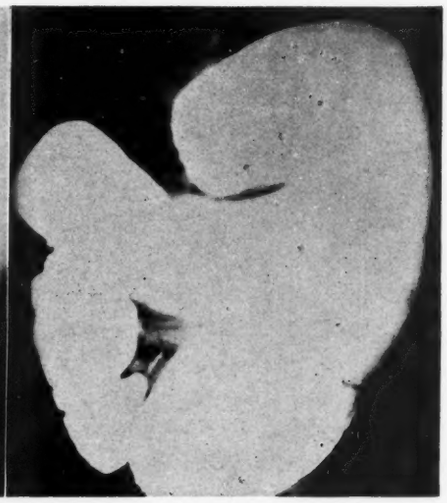


Fig. 2. The evacuation film reveals that the patient was unable to pass any of the enema.

Fig. 3. Barium enema on June 5, 1944, reveals moderate dilatation of the transverse, descending and sigmoid colon. Rhythmical peristaltic waves were seen throughout the large bowel.

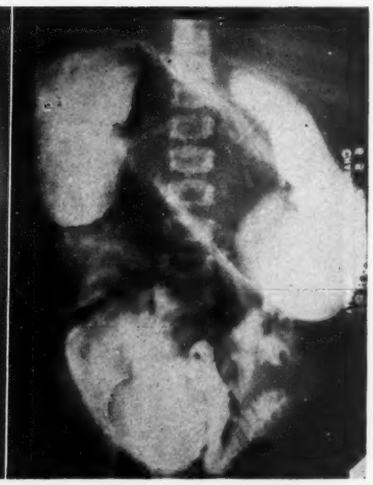


Fig. 4. The evacuation film reveals patient was able to pass about three-quarters of the contained barium. There is a moderate amount of air remaining in the large bowel.

Among the twenty-two patients treated by sympathectomy (Wade, Judd, Adson, Rankin, our case report included) only one death occurred; this followed an attack of pneumonia, occurring two months after operation. Except for two cases, all postoperative results have been reported as satisfactory.

Different types of operations have been described and used with more or less success in the treatment of Hirschsprung's

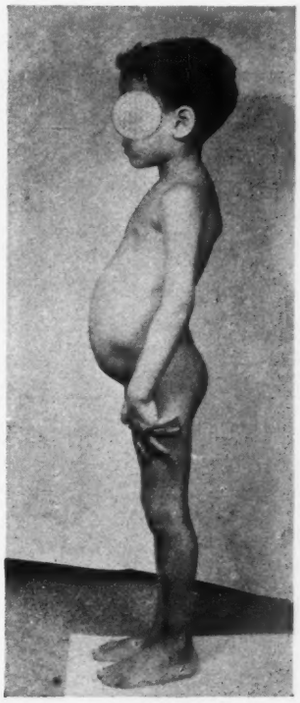
disease. Plastic operations, plication of the colon, short circuiting procedures, most of them have been found to be inadequate and probably possess only historical value at the present time. Radical resection of the diseased colon was for some time the operation of choice and is still being successfully used in selected cases. The operative risk is rather great, usually 25 per cent mortality or more in the hands of the best surgeons, with recurrences not infrequent.

Medical Treatment, 252 cases	Per Cent
Mortality	66 to 98
Cures or improvement	2 to 12
Surgical Treatment Other than Sympathectomy, 238 Cases	
Mortality	26 to 48
Cures or improvement	34 to 79
Sympathectomy, 22 Cases	
Mortality	4.5
Cures or improvement	90

Having the previously mentioned etiological factors in mind, it would appear that in cases of acquired megacolon, in which primary obstructive causes may be present, radical resection of the diseased part of the colon is probably a logical and successful procedure. But in all cases in which there is apparent dysfunction of the neuromuscular mechanism, an operation for the correction of this condition should be the treatment of choice. The mortality rate for this type of operation is almost negligible, also excessive morbidity and prolonged hospitalization are markedly decreased.

The following operative procedures are all based on the same principle, that of eliminating the excessive stimuli of the sympathetic nervous system in the involved portion of the colon, and perhaps, thereby creating a condition of relative overstimulation of the parasympathetic innervation.

The removal of the first and second lumbar ganglia on the left as advocated by Wade, seems to be successful in moderately severe cases. The resection of the inferior mesenteric nerves in conjunction with resection of the presacral nerve has given



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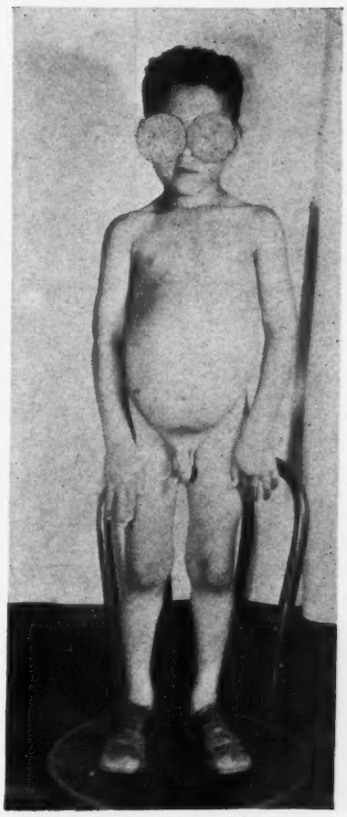

B

FIG. 5. A, side view; B, front view of patient showing still some moderate enlargement of the abdomen about one year after operation.

good results, as reported by Rankin and Learmonth. Bilateral sympathetic ganglionectomy, including the resection of the intervening trunk is practiced successfully by Adson and Judd.

There are too few reported cases of megacolon treated by sympathectomy to enable us to arrive at final conclusions. It can be stated that most of the reported cases showed considerable postoperative clinical improvement. Distention and dilatation of the abdomen in some cases were only slight, and in others were not relieved.

CASE REPORT

Ch. C. A., a three year old colored boy, was admitted to the pediatric department of the Charleston General Hospital September 29, 1942, with the complaints of constipation, and enlargement and distention of the abdomen.

The mother stated that since birth the patient had never had a normal bowel movement and that occasionally he was unable to evacuate his bowels for several days and sometimes as long as a week, in spite of cathartics and enemas. The patient had required laxatives all of his life, large doses frequently being necessary. The stools were usually firm. His abdomen had always been large and apparently distended with gas. His condition had gradually become worse. He had not had a satisfactory bowel movement during the last two weeks. There was no vomiting but occasional nausea. His appetite was only fair. This child became listless and inactive recently and the mother was very much concerned about his general welfare and was very anxious that something be done to improve the boy's condition.

Examination on admission revealed that the patient was fairly well developed for his age and fairly well nourished, lying in bed inactively, but without signs of acute distress. His temperature was 99.4°F.; the skin was rather dry. The outstanding feature was marked enlargement of the abdomen, moderate distention over the entire abdomen; there were areas of dullness in the lower part of the abdomen probably due to fecal impaction. The intercostal angles were somewhat wide and obtuse, apparently the result of increased intra-abdominal pressure.

Clinical laboratory findings were as follows: Kline exclusion test negative; urinalysis: specific gravity 1.001; reaction acid; sugar and albumin negative; 2 to 3 pus cells per field. Blood picture: hemoglobin 50 per cent; erythrocytes 3,800,000; leucocytes 10,600; color index 0.6; lymphocytes 31 per cent; monocytes 2 per cent; neutrophils, stabs 5 per cent; neutrophils, segments 52 per cent and eosinophils 10 per cent.

Stool examination for ova and parasites was negative. Stool culture showed Faecalis alcaligenes.

Roentgenograms were made September 30, 1942. A barium enema revealed a moderate dilatation of the transverse, descending and sigmoid colon due to megacolon. No peristaltic waves were visualized under fluoroscopic examination. The evacuation film revealed that the patient was unable to pass any of the enema. It was obvious that this child was suffering from congenital idiopathic dilatation of the colon.

For more than three weeks, this patient was treated by dietary management (low residue diet) with daily enemas and mineral oil by mouth and as a retention enema with only fair results. It was believed that surgical treatment might improve the patient's condition.

As the disorder was entirely left-sided, unilateral lumbar sympathetic ganglionectomy was proposed. After several small blood transfusions had been given this patient underwent operation on October 23, 1942, at which time a left sympathetic ganglionectomy was performed by one of us (H.A.B.), resecting the second, third and fourth lumbar ganglia by transperitoneal Adson approach. The resected ganglia and rami did not show any pathological changes.

The abdomen was entered by way of a left paramedian incision. The splenic flexure of the transverse colon, descending colon and sigmoid showed the true picture of megacolon—marked dilatation and hypertrophy of the intestinal wall. A large amount of fecal material could be palpated in the distended part of the colon. Only sluggish peristalsis could be observed. The rest of the colon and small bowel were about normal in appearance. There were no findings indicating any obstructive lesion.

The postoperative course was uneventful. The temperature rose on the first postoperative day to 101°F., rectally and came down to normal the next day and remained so for the remainder of the patient's stay in the hospital.

The temperature of the left leg compared with that of the right was markedly increased. On the second postoperative day the patient was put on a diet for age as tolerated and small saline enemas were given daily with prompt results. The enemas were gradually discontinued and mineral oil then given by mouth.

Within a few days after operation, a marked change could be noticed in the general appearance of the patient. He became interested in his surroundings, was active and his appetite improved. He was discharged on November 11, 1942, and his mother advised to bring him in monthly for check-up.

The mother was very cooperative and lived near the hospital, so that frequent observations of this patient could be made. During the patient's following visits to the hospital general improvement could be noticed. The mother stated that the child was doing nicely and that his general condition was much better than before the operation. She stated that enemas were no longer necessary to secure bowel movements but that it was necessary to give him mineral oil almost daily for the first few months following operation.

The last time this child was seen, June 15, 1944, more than one and one-half years after operation, the abdomen was still moderately enlarged but otherwise he seemed to be quite well. *X*-ray studies done at this time revealed: "A moderate dilatation of the transverse, descending and sigmoid colon. There were definite peristaltic waves visualized at the time of the fluoroscopic examination. An *x*-ray study taken after evacuation indicated that the patient was able to pass about three-fourths of the barium enema. There was a moderate amount of air remaining in the large bowel."

CONCLUSIONS

1. A brief review has been made of the different etiological factors and types of treatment of megacolon.

2. It was noted that marked clinical improvement followed different types of sympathectomy.

3. Sympathectomy involves comparatively little operative risk, and as the statistical review indicates, shows a very low postoperative mortality.

4. The case of a patient with megacolon successfully treated by unilateral lumbar ganglionectomy is reported.

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BLADDER HERNIATION AND KIDNEY STONE

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THE points in the following case which we think worth while emphasizing are:

1. The original vaginal hysterectomy for "uterine prolapse" instead of a thorough hernioplastic rebuilding for injured pelvic floor with extensive herniation, does not accord with the alleged findings. We find that vaginal and abdominal hysterectomy as a single operation is performed erroneously for these extensive herniations, and it seems apparent that it is a result of the faulty nomenclature of "prolapse of the uterus." One of us (C.B.) published a paper on the hernial nature of these conditions (*Am. J. Obst.*, 1909).

2. It seems worth while to again call attention to the two distinct portions of the bladder, one part still in the abdomen and unharmed, and one part herniated and suffering from circulatory disturbances. This is easily a prey to infection and is constricted by the pelvic floor ring, making of the bladder in many cases an hour-glass structure.

3. A technic of vaginal vault attachment with vaginal and fascial narrowing and substantial pelvic floor rebuilding is shown to restore these structures to position, even in those cases in which there is marked herniation after hysterectomy when there has been no vaginal attachment or pelvic floor hernioplastic repair. This to us seems preferable to vaginal obliteration.

4. This case, with infection, engorged lymphatics, obstructed circulation, edema, infected and choked urinary tract, degeneration of tissue, with epithelial change, illustrates the desirability of preliminary preparatory treatment, with rest in bed, and retention of herniated structures in the pelvis by the Sims position, and slight Trendlenburg position and tampons, so that edema and infection will subside, circulation and tissue degeneration will improve and the bowels and urinary tract be disengorged.

5. In this case on account of the kidney pelvis containing pus, a half sitting posture should be assumed for a short time several times a day.

6. We fear that repeated kidney catheterization with irrigations may do more harm than good.

7. Such extensive infection is most unfortunate and should not occur often.

8. One of the chief values of this report is to emphasize again the hernial nature of the condition to be overcome.

CASE REPORT

There came under our observation a Mrs. A., age sixty-five, whose case presents some unusual points and emphasizes facts not usually accepted, which should receive more general recognition. She was an overweight woman, appearing very sick, a bedridden patient, who seemed without hope of recovery. It was rather difficult to persuade her that treatment of a surgical nature was worth while, as she had been told repeatedly that nothing could be done.

The patient presented a history of long standing pelvic floor herniation, for which she had been operated upon for "prolapse of the uterus" *two years* previously. The condition according to description was a rather extensive herniation of the bladder and uterus, with some involvement of the rectum. The operation had been chosen according to the nomenclature of "prolapse of the uterus" and nothing was done to replace or retain the remaining herniating organs in the abdomen. Unfortu-

nately, a very severe suppurative process followed the vaginal hysterectomy, which process involved the vagina, intrapelvic structures and the bladder. The patient reported a very severe inflammation of the vulva and area around the rectum as well. During this sickness she had chills and severe pain in the left part of the abdomen and in the lumbar region, indicating a probable pyelitis.

From these conditions the patient continued to suffer for the two years following the operation, until coming under the care of one of us (R.B.). She then complained of severe headache and severe colicky pains, with swelling, and of urine containing pus and blood. The large part of the vagina and bladder were protruding and were accompanied by a smaller portion of the rectum, all of which were smeared with a constant foul discharge. An incontinence of urine was present. She had spent most of the two years in bed.

The patient was seen in consultation by us after some improvement had resulted from douches and efforts to keep the herniations reduced. As they had to make some arrangements, it was decided that this treatment should be continued until she could be gotten in the hospital, when bladder irrigations should be added, and a cystoscopic, ureteral and kidney study should be made. A tentative diagnosis of bladder, vaginal and rectal herniation through the pelvic floor, a marked cystitis, and ascending ureteritis, pyelitis, pyonephrosis and probable kidney stone were present.

She entered the Augustana Hospital, January 28, 1944, and underwent observation and preparatory treatment. Cystoscopic and ureteral study by Dr. Scully revealed a bladder with findings of severe trabecular cystitis in the portion of bladder protruding from the pelvis and a normal bladder mucosa lining the portion of the bladder within the abdominopelvic cavity, not only verifying the hernia, but showing the damaging effects of the herniation upon the bladder wall. The ureteral openings were located but no fluid was found spurting from the left ureter. The right ureter was spurting at regular intervals, a rather cloudy urine, and ureter and kidney pelvis were found normal. An *x*-ray study by Dr. Beilin found a normal right kidney, but a decidedly enlarged left kidney with a cloudy shadow, suggesting stone.

The patient was subjected to left nephrectomy on February 9, 1944. The kidney was found large and contained an irregular stone surrounded by bloody pus. She made a good recovery and went home for recuperation treatment February 24, 1944. She returned March 12th for a hernioplastic repair for the pelvic floor hernia March 13, 1944.

The anterior vaginal wall was laid open and the redundant vaginal and bladder fascias were reduced in size, and a portion of anterior vaginal wall removed. The posterior cul-de-sac was opened and the broad ligament stumps were recovered and sewed to the vaginal vault and sides. The posterior vaginal flap was then raised and a very thorough hernioplastic reconstruction was done upon the muscles and fascias of the pelvic floor, making the pelvic floor somewhat more closed than in the normal condition. The patient now reports normal bladder retention, absence of protrusion and freedom from abdominal and lumbar pain.

SUPRAVESICAL INTERNAL HERNIA*

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INTERNAL hernias as a cause of acute intestinal obstruction are rare surgical conditions. When the obstruction is caused by an internal supravesical hernia, it is even more unusual. In 1940, Warvi and Orr[1] in an exhaustive study of the literature found reports of thirty-seven cases with findings definite enough to be classified as internal supravesical hernia. Twenty-eight of these cases of supravesical hernia were of the prevesical type. In all the authors found twenty-two names had been used to identify this unusual hernia, thus making classification difficult. Stalker and Gray[2] in 1939 reported twenty-nine cases of internal hernia seen at the Mayo Clinic since 1910, only one of which was of the supravesical type. In addition to the twenty-eight cases reported by Warvi and Orr two more cases of prevesical hernia have since been reported in the literature.[3,4]

Supravesical hernias develop in the supravesical space which is bounded by the lateral umbilical folds (obliterated hypogastric arteries), the pubis and the peritoneal reflection over the bladder. This space is also divided into right and left halves by the remnant of the urachus. A hernia into the supravesical space may appear externally (a more common type), the hernia presenting in the inguinal, femoral and obturator areas. The more rare internal type may be prevesical (space of Retzius), paravesical (lateral) or intravesical. The exact cause of a supravesical hernia is not understood but a diverticulum first forms into which a loop of intestine becomes engaged with resulting strangulation.

The author recently encountered a case of acute intestinal obstruction caused by a strangulated prevesical hernia. This was the second strangulated internal hernia seen in our small hospital in twenty-four years, the other being the result of a herniation through the broad ligament (postoperative).

CASE REPORT

Mr. T. J., age sixty-seven years, was admitted to the hospital at 10 P.M. February 5, 1944. His past history was negative for serious illness and injury and he had had no previous abdominal symptoms. At 11 A.M. February 2nd, while standing at a farm sale the patient developed sudden colicky abdominal pain followed by vomiting. His pain was periodic but mild and he vomited infrequently. He had normal stools the first day but none thereafter and no flatus was expelled. Two hours before admission he was seen by his physician, Dr. L. I. R. Hegg, of Rock Valley, Iowa, who referred him to the hospital with a diagnosis of acute intestinal obstruction.

On admission the patient's general condition was good; temperature, pulse and respirations were normal and his attacks of pain were infrequent and not severe. He showed definite dehydration and moderate abdominal distention. There was some tenderness to the left of the umbilicus but no mass was palpable. Peristalsis was active. No external hernia was present and a rectal examination was negative. No bladder symptoms were present. The white blood count was 9,000 and the urine was normal. During the night the patient was treated by intravenous fluids and gastric suction and one hypodermic of morphine was given. By morning the dehydration was decreased and *x*-ray examination of the abdomen showed dilated loops of small intestine with fluid levels. A barium enema showed a normal colon. A diagnosis of mechanical intestinal obstruction from an undetermined cause was made.

Twelve hours after admission the patient's abdomen was explored through a left para-

* From Le Mars Clinic, Le Mars, Iowa.

median incision below the umbilicus. The peritoneal cavity contained serosanguineous fluid, several loops of dilated small intestine were present and a loop of small intestine was herniated into the supravesical space just to the right of the midline. The scarred neck of the sac was incised and a loop of small intestine 5 to 6 inches in length was delivered. Circular pressure areas were present but the strangulated loop was not gangrenous. The neck of the peritoneal sac admitted two fingers; the diverticulum was four inches deep and extended into the prevesical space, the peritoneal lining being adherent to the prevesical fat. The neck of the sac was further scarified and was closed by cotton sutures. Proximally, several loops of small intestine were adherent to each other by fine fibrous non-obstructing adhesions. The incision was closed and the patient treated by gastric suction and intravenous fluids. He made an uneventful recovery and was dismissed from the hospital on the twelfth postoperative day.

A correct preoperative diagnosis of supravesical hernia has been made only once, Fromme, in 1908, making a correct diagnosis by clinical and cystoscopic findings. In a given case of acute intestinal obstruction one might make a correct diagnosis if the patient had no apparent cause for the obstruction but had suprapubic tenderness, urinary frequency and compression of the bladder fundus as seen on cystoscopy. In treating a supravesical hernia removal of the adherent peritoneal sac is not necessary; scarification of the neck of the sac and simple closure seem sufficient. The mortality in the cases reported in the literature was high due to the strangulating obstruction.

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PENDULOUS ABDOMEN

ITS SURGICAL CORRECTION

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A PENDULOUS ABDOMEN is not uncommon among female patients. It is not unusual to find a lipomatous apron in obese persons extending down to the upper thigh region and interfering with the individual's gait. This is particularly true of female patients who resort to various types of corsets and foundation garments for postural support. The extreme obesity and the excessive pendulous abdominal fold in the patient constituting the subject of this paper make this case report unusual.

CASE REPORT

During the course of the first interview with this patient, it was learned that the onset of her menses took place when she was seventeen and one-half years old. They were always irregular, of a sixty to ninety day interval, and had not occurred since the time of her

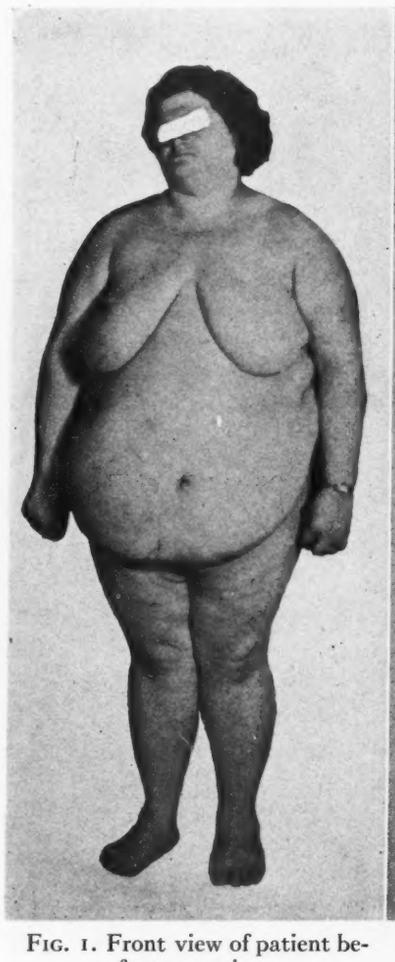

FIG. 1. Front view of patient before operation.

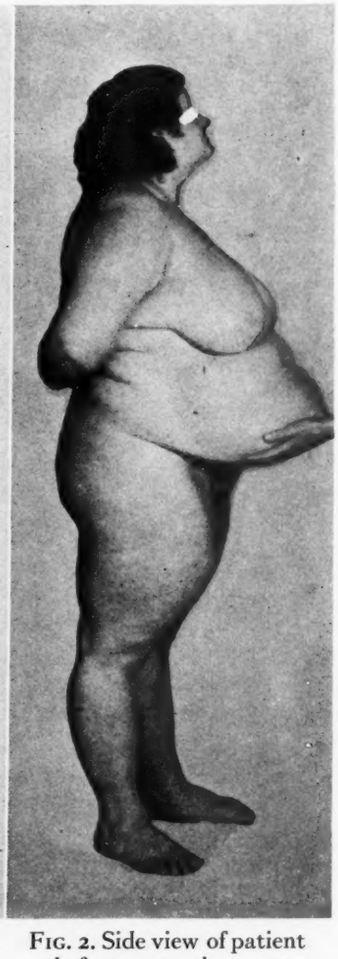

FIG. 2. Side view of patient before operation; note the size of supported abdominal fold.

operation three years previously. She had never been pregnant and as far as she could remember, she was inclined to be overweight.

Her recent gain, however, amounted to nearly 100 pounds. Her general health, nevertheless, was good and she took pride in her strength and endurance. Despite this patient's evident glandular dyscrasia, the family situation made resort to surgery of the character of an emergency. The patient was informed of the risks and prognosis of an operation of this type, but under the pressure of home circumstances, she made light of them and insisted on immediate operation.

Following a pelvic operation three years previously, this twenty-six year old woman gained weight rapidly. She was 61 inches tall and weighed 265 pounds. Most of her increase in weight seemed to occur about her abdomen which progressively became pendant, the fold hanging to within 7 inches of her knees when she was in a standing position. (Figs. 1 and 2.) A voluminous right-sided incisional hernia aggravated her distress.

The patient was sensitive of her appearance and unhappy because her marital relations became strained, her husband threatening divorce proceedings unless steps were taken

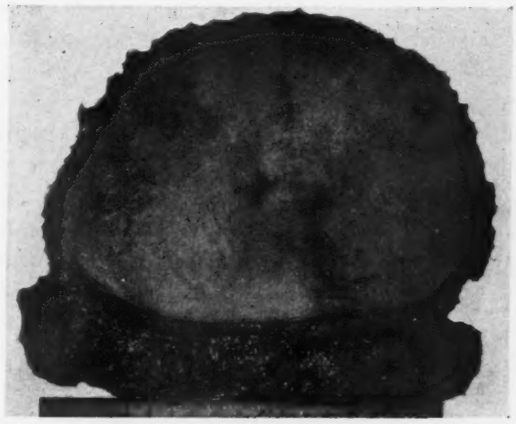

Fig. 3. Elliptical fold removed at operation; weight sixty-four pounds.

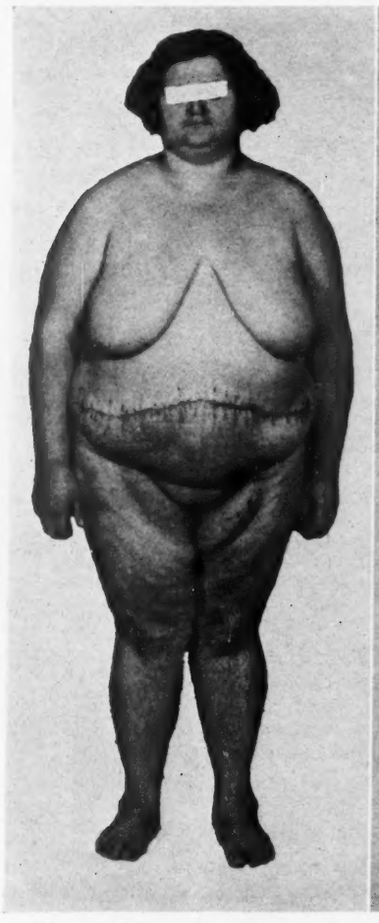

Fig. 4. Front view of patient four weeks after operation.

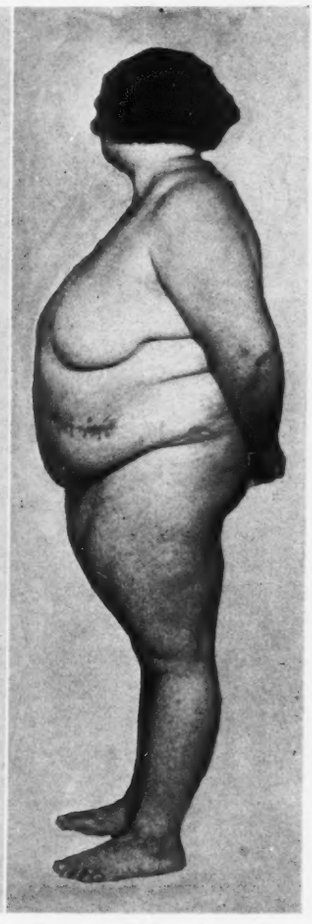

Fig. 5. Side view of patient four weeks after operation.

to correct her uncomely condition. Rigid dietary restrictions appeared to have little influence on the upward trend of her weight.

Under ethylene oxide-oxygen anesthesia an elliptical incision extending 7 inches above and 9 inches below the umbilicus was made, the two apices reaching laterally to the crest of each ilium. The incision extended through 5 inches of fatty tissue before exposing the anterior abdominal fascia.

All scar tissue was resected, as was the hernial sac. The hernial defect in the abdominal wall measured 4 inches in diameter. This latter was closed by a modified Mayo operation technic, drawing one flap under the other and anchoring both with a double mattress suture. The skin margins were approximated by means of interrupted dermal reinforced with six silkworm tension sutures.

The removed elliptical skin and subcutaneous lipomatous fold measured 16 by 21 inches, and weighed 64 pounds. (Fig. 3.)

The postoperative course was uneventful, the sutures were removed on the tenth day, and the patient was discharged from the hospital on the fourteenth day after operation.

Under a balanced, restricted dietary regimen and glandular therapy, the patient's weight three months after operation appeared controlled, there being no appreciable increase over the recorded weight noted on the day of hospital discharge.

The physical results in this patient (Figs. 4 and 5) can be measured only by the mental improvement, the eased marital relations, and the general sense of well being. The patient was sincere in the gratitude expressed that her home was not disrupted.

INJURED nerves may be anatomically or physiologically interrupted. Davis states that there is no way by which complete anatomical or physiological interruption can be differentiated. If there is doubt about complete or partial anatomical division of a nerve, operation may be postponed for four to six months to await evidence of nerve regeneration.

From "Operations of General Surgery" by Thomas G. Orr (W. B. Saunders Company).

MULTIPLE PRIMARY MALIGNANCY

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BILLROTH formulated the following requirements which he considered necessary to make a diagnosis of multiple primary malignancy: (1) Each tumor must have an independent histologic primary appearance; (2) the tumors must arise in different situations, and (3) each tumor must produce its own metastasis. The first two requirements seem reasonable, while the third does not always occur in single primary malignancy, notably adenocarcinoma of the fundus of the uterus.

The criteria of Goetze for a diagnosis of multiple primary malignancy seem more reasonable: (1) The tumors must have the macroscopic and microscopic appearance of the usual carcinomas of the organs involved; (2) exclusion of metastasis must be certain, and (3) diagnosis, in each case, may be confirmed by the character of the individual metastasis.

Warren and Gates criteria for a diagnosis of multiple primary carcinoma seem most reasonable, and, to us, sufficient for such a diagnosis: (1) The tumor must present a definite picture of malignancy; (2) each must be distinct, and (3) the probability of one being a metastasis of the other must be excluded.

As Portuonda says, in his report of a case of three primary malignancies, "Thus while Billroth makes the production of metastasis—an accidental occurrence—one of the essentials, Warren and Gates stress only the intrinsic characteristics of the neoplasm."

We shall not concern ourselves with the question whether the occurrence of multiple primary malignancy is mere coincidence or is an example of tumor diathesis. This case report may be added to those cases of multiple primary malignancy already reported and may serve as a source of speculation for those interested in this side of the question. A fairly careful search of the literature revealed no case of four primary malignancies in one patient; and, although there may be no scientific significance to the occurrence of multiple primary malignancies, this case should be of interest.

CASE REPORT

I. S., aged sixty years, a housewife, was admitted to the Brooklyn Cancer Institute, May 26, 1941. Her chief complaint was cramps in the lower abdomen, for the past year. She said that she had run a temperature since May 1, 1941. Her father died at seventy; mother died at sixty-five years. The patient said they died of old age. Cardiac, diabetic, or tumoral history in the family was denied; there was no history of tuberculosis.

The patient did not remember any childhood diseases. Menstruation began at thirteen years and was regular. She was a para III, gravida III, and was married at twenty years of age. Her surgical history included removal of the left breast in 1922, at Mt. Sinai Hospital, New York; removal of ribs in October, 1939; removal of chest nodule March, 1941, at Mt. Sinai Hospital, New York; dilatation, curettage and *x*-ray therapy for cancer of the cervix in April, 1940, at the Memorial Hospital, New York. The patient denied any signs or knowledge of venereal disease. There was a loss of ten pounds during the year, and complaint of muscular and joint pains.

During the past year the patient had frequent abdominal pains. Since May 1, 1941, there was vaginal spotting, associated with pain over the left kidney, and nocturia.

The patient appeared to be about sixty years old, fairly well nourished, who showed signs of recent weight loss. Her eyes reacted to light and accommodation. There was no pathological condition of the ears, nose, throat, or teeth. The tongue was glossy and red. The

mucous membrane of the angle of the mouth showed signs of B_2 deficiency. No glands could be palpated in the neck. There was an old mastectomy scar on the left side of the chest. and there was absence of the fourth, fifth, and sixth ribs on the left side. There was a presystolic murmur present, the heart sounds were of good quality, and the apex beat was visible. The blood pressure was 127/75. No dullness was detected in the lungs. Somewhat feeble breath sounds were elicited over the right lung field. The abdomen was pendulous, soft and not distended. There were no signs of venous distention, nor abdominal tenderness. The liver and spleen could not be palpated. There was pain over the left kidney region. The vaginal introitus was snug. A firm mass was felt at the left, filling the cul-de-sac, extending three inches above the symphisis. A tumor about the size of a walnut, which was painful to the touch, could be felt in the rectum. No glands could be felt in the groin. There was no pathological condition of the extremities, and all reflexes were present.

FIG. 1.

FIG. 2.

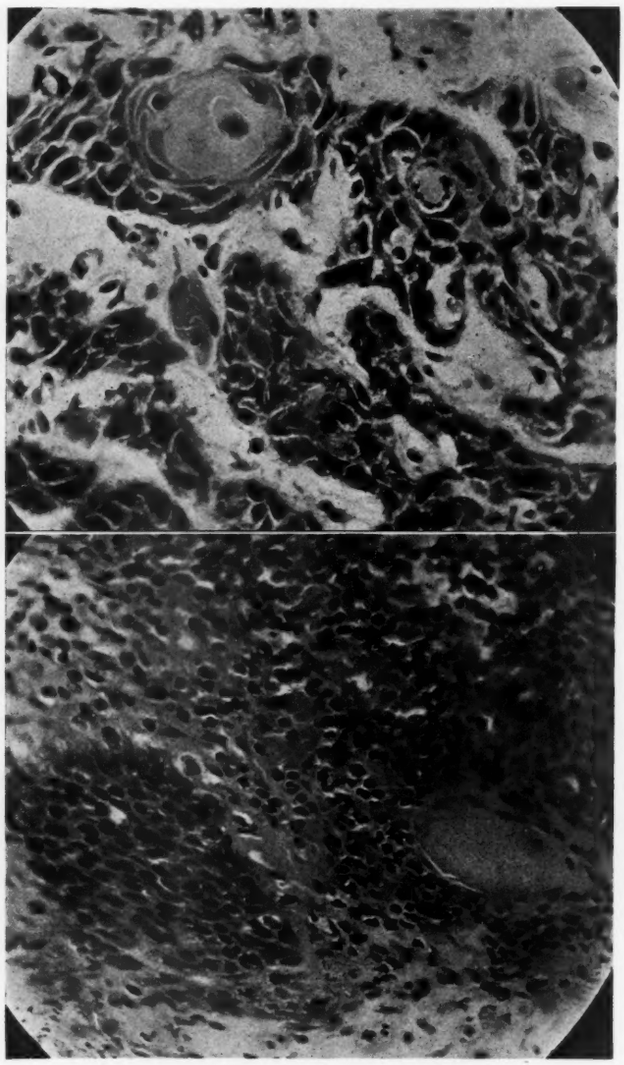

FIG. 1. Post-radiation epidermoid carcinoma (squamous cell type).
FIG. 2. Recurrent nodule in scar of chest wall (squamous cell type).

Examination on May 28, 1941, showed that the patient had a cancer of the cervix, treated at the Memorial Hospital, New York, with radium and *x*-ray therapy. Admission diagnosis was acute pyelonephritis. Pelvic examination revealed a contraction of the vault of the vagina; the cervix was not palpable. Rectal examination revealed a hard, solid, fixed mass

3 inches from the anus. The greatest extent of the mass appeared anteriorly.

At the genitourinary examination a No. 24 wall of the rectum. This mass was hard and irregular and appeared to be somewhat movable. The tip of the examining finger could be

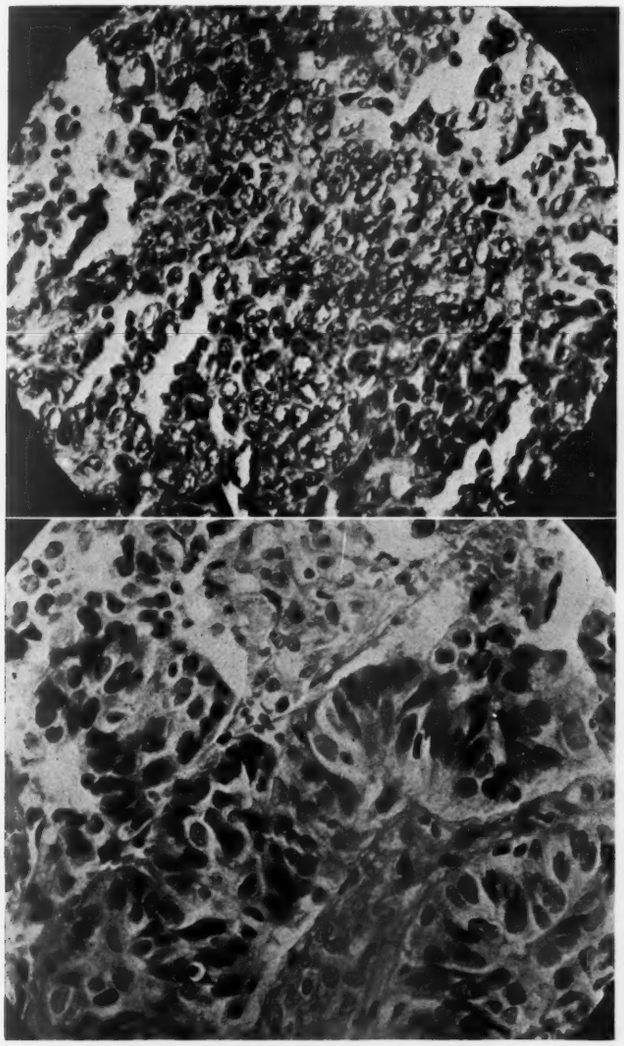

Fig. 3.

Fig. 4.

Fig. 3. Epidermoid carcinoma of cervix (transitional cell type).

Fig. 4. Papillary adenocarcinoma of rectal origin.

scope was easily introduced. No neoplasm or calculi were noted. The mucosa appeared normal; a turbid bladder urine was present; the bladder capacity was normal and the orifices were in the usual locations. The left ureter was catheterized without obstruction and clear urine was obtained. On the right side, there was an obstruction at the ureteropelvic junction and the urine was turbid. Indigo carmine was injected; a return occurred from the right side in eight minutes, with fair concentration, and from the left side in six minutes, with fair concentration.

Digital examination revealed a cauliflower mass arising from the anterior and left lateral passed over the summit of the mass, which was 4 inches above the anus. The mass was grayish red and friable. The scope was passed beyond this mass, but no other pathological condition was found.

On June 4, 1941, after intravenous pyelogram, both kidneys appeared normal in size, shape and position. The right kidney functioned poorly, the left kidney more poorly. The right pyelogram was normal, the left showed moderate hydronephrosis. The bladder was completely filled. *X*-ray examination, on June 6, 1941, after retrograde pyelogram revealed that both ureter catheters ascended as far as the renal pelves. The right pyelogram

and ureterogram were very slightly dilated, apparently within normal limits. The left pyelogram showed moderate hydronephrosis.

A letter received from the Mount Sinai Hospital, New York City, dated June 16, 1941, contained the following information:

Patient I. S. Summary: Nineteen years ago (1922), Dr. Howard Lilienthal performed a left radical mastectomy for medullary carcinoma. This was followed by radiation. The patient was admitted to the Mt. Sinai Hospital again October 2, 1939. In the midst of the scar, a small ulcerative lesion began and this had increased slowly in size. At operation, by Dr. Harold Neuhof, the cage about the ulcer was freed and excised down to, and including, the pleura. In order to close the defect the opposite breast was freely mobilized by the appropriate incision and sutured over. The patient made an uneventful convalescence and the wound healed by primary union, except for a small area far removed from the site of plastic closure. Date of discharge was October 27, 1939.

In view of the pathological examination revealing squamous cell carcinoma, the assumption of radiation as the cause of the lesion had been warranted.

The patient was again readmitted March 4, 1941, for the removal of a nodule of the chest wall, which was a recurrent squamous cell carcinoma. The patient was discharged the same day.

Unfortunately the slide of the medullary carcinoma of the breast was lost from the files of the Mt. Sinai Hospital. Figures 1 and 2 show the post-radiation squamous cell carcinoma and the recurrence in the chest wall.

The section examined microscopically was one from the skin in which there was noted ulceration of the epiderm. In the underlying subcutis a neoplasm was noted composed of alveolar masses of polyhedral-shaped cells with pale pink cytoplasm, showing hyperchromasia of the nuclei. Areas of keratinization and definite epithelial pearls were noted. There was also a marked vascular proliferation of the small capillaries present. The deeper portions of the subcutis showed marked fibrosis and focal areas of round cell infiltration.

A letter received from the Memorial Hospital, June 5th 1941, was as follows: "Patient I. S. was first in this clinic April 6, 1940; the diagnosis was carcinoma of the cervix, primary. The patient received *x*-ray therapy and was admitted May 23, 1940, for a cervix tandem, for a dosage of 3,000 mc. hrs. She was discharged May 26, 1940. She has not returned to this clinic since her discharge, but our social service department has informed us that the patient was operated upon in Mt. Sinai Hospital in March, 1941. Our pathologist reported epidermoid carcinoma, grade III, on cervical biopsy done, April 16, 1940, in this hospital."

Microscopically, the section was one of a neoplasm, which was composed of a diffuse growth of round and polygonal-shaped cells, the cells having a rather pale, granular, cytoplasm. Many mitotic figures were noted. Many of the nuclei showed marked hyperchromasia. There was no evidence of keratinization or pearl formation present. The stroma was composed of rather vascular fibroblastic tissue showing marked round cell infiltration. There was no evidence of normal cervical tissue present in the section.

A photomicrograph of a biopsy from the rectum taken at The Brooklyn Cancer Institute is shown.

Microscopic examination revealed that no normal surface lining was present. The surface was covered by a purulent and necrotic layer. The underlying tissue was composed of sheets of tumor cells arranged as multiple papillary masses. The individual cells were columnar or polyhedral in type. They had chromatic or vesicular nuclei, which varied considerably in size and shape. Regular mitotic figures were common. The stroma was infiltrated with leucocytes and plasma cells.

A follow-up of the patient, who made her last visit to the Brooklyn Cancer Institute on June 30, 1941, showed that she died at home on November 27, 1941. No autopsy was obtained.

SUMMARY

1. A case report is given in which a patient had four primary carcinomas: (1) A medullary carcinoma of the breast; (2) a post-radiation carcinoma in the scar of the chest wall, with recurrence; (3) a transitional cell carcinoma of the cervix, and (4) a papillary adenocarcinoma of the rectum.

2. All lesions differed histologically and no lesion was a metastasis of another.

3. It is regrettable that we were unable to show the microphotograph of the breast lesion, but we can accept the diagnosis made at so reputable an institution as the Mt. Sinai Hospital of New York.

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FRACTURE DISLOCATION OF THE FIFTH CERVICAL VERTEBRAE

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THIS case occurred as a result of an automobile accident in the vicinity of a naval air station.

The patient, a twenty-four year old seaman, was brought to the dispensary by a private ambulance and no medical aid was given while in transit. He was seen by a medical officer about thirty minutes after the accident.

The patient stated that after the initial impact his head, acutely flexed, was thrown against the dashboard, and rotated to the right. Immediately following the injury he experienced total paralysis of the lower extremities.

Initial physical examinations revealed the following findings: Blood pressure 88/60, pulse 120. Respirations shallow and abdominal in type. The head was semi-flexed and rotated to the right side. He was unable to move the lower extremities and there was loss of cutaneous sensation up to the level of the mammary glands on both sides. The lower limbs were flaccid; no babinski sign was present. There was no ankle clonus. Chadduck's, Hoffman's and all other pyramidal tract pathological reflexes were absent. There was no knee or ankle jerk. The cremasteric and superficial reflexes were absent. The upper extremities were moved with difficulty, but the deep and superficial reflexes were normal. The cranial nerves reacted in a normal manner. Priapism was present and persisted until after pentothal anesthesia. The sensorium was not affected.

Treatment consisted of maintenance of the cervical region in traction and extreme extension; 1,300 cc. of liquid plasma was given and the patient was treated generally for shock. No morphine was used initially to avoid respiratory complications due to intracranial injury or cord involvement. A portable film of the cervical region was taken. This revealed a fracture dislocation of the fifth cervical vertebrae. The body of this vertebrae was displaced about 3 cm. dorsally obliterating the continuity of the neural canal in this area. It was assumed that the physical findings were due to compression or transection of the spinal cord due to displacement of the fifth cervical vertebrae. Immediate reduction was decided upon. Initial therapy had improved the shock-like state. The blood pressure had risen to 110/70, the pulse was of good quality, rate 100, and it was believed that radical therapy could now more safely be instituted.

Seven cc. of 5 per cent sodium pentothal was given intravenously. Under this anesthesia traction was applied to the cervical region and the head was gently rotated to the left. An audible click was heard when the vertebrae assumed the anatomical position. There was a definite sense of crepitation experienced at the same time. Extension was maintained and the neck was then gently rotated to the right. The click and crepitation were again elicited. Upon rotation of the neck to the midline another film was taken. This revealed the vertebrae in the anatomical position. The neck was then placed in extension with a neck and semi-body cast.

Immediately after reduction there was no change in the neurological findings. The blood pressure remained sustained and in spite of the pentothal anesthesia, respirations were not embarrassed. The mobility of the upper extremities appeared somewhat improved. Priapism had disappeared and remained so after the anesthesia.

Weather conditions prohibited immediate transfer of the patient via ambulance plane to a naval hospital. However, within six hours he was placed in an ambulance plane and transported 400 miles by air. He was given oxygen en route and, in general, his condition remained unchanged.

Upon arrival at the naval hospital the patient was placed on tidal drainage and treated conservatively. Neurosurgeons reviewed the past reduction films and no further treatment was deemed necessary. The cervical cast was maintained.

On the second hospital day the patient ran a temperature of 105°F. Respirations were still of the abdominal type. An occasional dry râle was heard in both lung fields. In order to avoid

a hypostatic pneumonia he was given intravenous sodium sulfadiazine with the usual dosage. He was also placed in an oxygen tent. The lower limbs remained flaccid but a slight flexion of both great toes could be elicited upon testing for the Babinski sign. The superficial reflexes remained absent.

The patient slowly recovered from his respiratory difficulty and for the first ten hospital days there was no change in the neurological signs. About one month after the injury the patient could move his neck freely with no pain and there was almost complete return of function of the upper extremities. The lower extremities still remained flaccid, however. As the patient had been transferred to a naval hospital, complete data on neurological findings are not available now. However, it appeared as if the patient were slowly making a recovery comparable to that of a spinal animal after complete transection of the cord.

SUMMARY

1. A case of complete transection of the spinal cord at the level of the fifth cervical vertebrae is presented. The writer believes that this case illustrates the necessity of immediate reduction when fracture dislocations are definitely diagnosed.

2. Five per cent pentothal sodium can safely be used as anesthesia during manipulation.

Necrosis of bone is due to periostitis, osteitis, osteomyelitis, irradiation or injury. *Toxic necrosis* is caused by phosphorus or mercury, often in association with bacteria. *Senile necrosis* (*quiet necrosis*) follows traumatism, probably with a mild associated infection.

From "Principles and Practice of Surgery" by W. Wayne Babcock (Lea & Febiger).

LIVER EMBOLUS FOLLOWING HEMORRHOIDECTOMY

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AND

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DETROIT, MICHIGAN

LIVER embolus as a complication of hemorrhoidectomy is included in the standard texts on proctology, but such a case is not revealed in a fairly extensive search of the literature.

A line of demarcation exists at the anus between the general circulation and the portal circulation through which postoperative emboli can travel to the lung, or rarely, as in this case, to the liver.

The diagnostic criteria found were: (1) Sudden upper abdominal distress gradually localizing to the right costal margin; (2) chill, followed by sharp rise in temperature and pulse; (3) nausea; (4) liver enlargement with pain on percussion or body movement, and (5) marked leucocytosis.

CASE REPORT

On February 12, 1943, a forty-three year old, white male was admitted to the hospital for hemorrhoidectomy. During the preceding two years he had experienced occasional discomfort from prolapsing internal hemorrhoids. Periods of constipation aggravated the distress and resulted in slight bleeding. He had been treated eighteen months for tabes dorsalis and reported no symptoms other than numbness around the waist. His systemic history was normal. Internal hemorrhoids and a small polyp were present. The rectum and pelvic colon were normal. The Kahn reaction was four-plus, and the urinalysis and blood count were normal.

Because of the tabes, caudal anesthesia was substituted for the routine 50 mg. procaine spinal administration. The small anal polyp and the internal hemorrhoids were excised using the composite technic of placing a plain catgut ligature above each hemorrhoidal area followed by excision, using no sutures for approximation. One plastic isthmus was created by connecting the rectal mucosa to the skin.

The postoperative course was uneventful. On the fourth day digital examination disclosed satisfactory progress and the patient was discharged.

During his ride home he was conscious of considerable jarring. At 9:30 P.M., three and one-half hours after dinner, he was seized with constant, severe, generalized, upper abdominal pain followed by a chill and recurrent nausea. There was no rectal pain. The next morning, on the fifth postoperative day, he returned to the hospital by ambulance.

Admission examination disclosed a temperature of 101.5°F., pulse 90, and respirations 27. The slightest body motion caused acute distress. There was point tenderness in the right upper quadrant in the nipple line 3 cm. below the costal margin. The abdomen was too tender for deep palpation. The leucocyte count was 12,250.

Twenty-four hours later, on the sixth postoperative day, the temperature rose to 103°F., with a corresponding pulse elevation but a normal respiratory rate. The liver was enlarged one-finger breadth below the costal margin and was tender to fist percussion. There were no ascites. The leucocyte count had doubled to 25,800. Blood culture taken at this time proved negative. The icteric index was normal. A few red blood cells appeared in the urine.

Medical and surgical consultation agreed on a diagnosis of "infectious hepatitis probably embolic."

Routine sulfathiazole 4 Gm. at once and 1 Gm. every four hours was started. After five days of sulfathiazole therapy the temperature, pulse rate and respirations were normal. At this time the leucocyte count was 10,650, blood sugar 105 mg., icteric index 2, direct Van den Berg negative, sulfathiazole blood level 2.3 mg. The patient was cheerful and free of distress.

Another chill occurred on the next day (eleventh postoperative), and his nose became "stopped up." On the twelfth postoperative

day the temperature rose to 102°F. The icteric index was 7 and sulfathiazole was discontinued. On the thirteenth postoperative day the temperature rose to 105.4°F., the icteric index was 3, the white count was down to 9,300, blood culture was negative. The liver enlargement had disappeared and pain was absent.

Forty-eight hours later temperature, pulse rate and respirations were again normal. The remaining convalescence was uneventful. A glucose tolerance curve indicated liver function was normal.

The patient recovered and was discharged on the twenty-fourth postoperative day, March 10, 1943.

Previous to the advent of sulfonamide therapy, a resultant liver abscess may have had a fatal termination.

Metastasis is both a medical and a surgical problem, yet most writers have considered it from the surgical point of view only. . . . Even when treating a simple furuncle, it is necessary to know that it can cause metastasis in the kidney and liver, or pyemia in infants, also that mumps metastasized to the testicle, pancreas, or breast in some instances.

From "Metastases Medical and Surgical" by Malford W. Thewlis (Charlotte Medical Press).

Bookshelf Browsing

AMERICAN SURGERY*

THE FIRST HUNDRED YEARS

FREDERICK A. PIZZI, M.D.
Assistant Attending Surgeon, Brooklyn Hospital
BROOKLYN, NEW YORK

OUR subject is American surgery, the first one hundred years. Space limits us to a fleeting survey, a momentary flash, an impressionistic glance at the peaks of that history. The characters in this reading were chosen as the representatives of scores of great contributors to American Surgery who are characteristic of their respective eras.

The early seventeenth century in Europe was one of great contrasts. Galileo was transforming the structure of science. Harvey, just eight years before the landing of the Pilgrims at Plymouth, announced the theory of the circulation of the blood and true medical scientists were attempting to solve the problems of diseased and normal life by new, advanced concepts. Academies of science sprang up as focal points of new knowledge. On the other hand, the Thirty Years' War had quenched nearly all intellectual life. The universities everywhere held fast to medieval forms and were incapable of perceiving the spirit of the new age. Practical medicine toddled along with the universities and was as reactionary as science was progressive. In the latter half of the century Sydenham began to bridge the yawning gap between scientific exactness and fantastic speculation and this work was not well advanced until Boerhaave's great clinical teachings began to pervade Europe in the eighteenth century. Thus it would be unjust to expect very much in medicine in the American Colonies at a time when there was so much left to be desired in Europe.

The earliest immigrants to America encountered their first dangers on the voyage over. The small over-crowded boats were assailed by storm, shipwreck, fire and disease. Malnutrition, scurvy, influenza and small pox beckoned the hand of death and half those who with high hope and new enthusiasm set sail from Europe, died before their ships anchored in American harbors. Those who survived faced new dangers: climate, typhoid, dysentery (because of primitive water supply), yellow fever, scarlet fever, and hostile natives. No less than half those who landed with the Mayflower died within three months.

How did the colonists manage? There were practically no physicians. Most ship surgeons went back with their crews, and those few who remained were merely surgeons; men recruited from an inferior class, therapists who served an apprenticeship and who had received no academic training. We recall that many of the colonists sought refuge from religious persecution. A good number of the clergy and elders, looking to the day the churches might be closed, had trained themselves for secondary occupations, carpentry, tailoring, and some had received medical lectures. And so the colonists turned to these clergymen who functioned as minister and physician. Others of the educated

* Read before the Brooklyn Hospital Quarterly Staff Meeting, November 9, 1942.

classes, such as governors and school masters, acted as physicians. John Winthrop, founder of Boston, sent back to England for medical books and with these and common sense, the early colonists received some primitive medicine. It must have been a peculiar mixture of religious medicine, folk medicine and some scientific principles. One invoked the Word of God, let blood or prescribed drugs to the best of one's ability.

During the eighteenth century, life in the colonies became more stabilized. New generations had been born in this land. The language and political forms of England were shared but other ties had loosened. The Atlantic crossing was tiresome and expensive. The new world was home. We had our own Cambridge with Harvard College founded in 1636. It was followed by Yale in New Haven in 1701.

Although these colleges had been founded so early there were no medical schools until half a century later. Therapy was taught by the apprentice method. As in the days of Hippocrates, a student would choose a master, go with him on his rounds, tend his horse and carriage, do chores and assist in compounding salves at home, and reading in spare moments whatever medical books were in the master's library.

A few fortunate ones, however, finished their education abroad, London and Edinburgh at that time being world centers of medical training. Laden with knowledge, the new doctors would return home and immediately would be sought after and pressed for information and instruction. Everyone wanted to learn from them and all were eager to hear what they had seen and heard.

To bring about changes, to approximate European standards, to keep step with progress abroad, this was the task of these men, these leaders who cleared the way.

Among the first was John Morgan, who lived from 1735 to 1789. He was the son of a Welsh immigrant. From earliest childhood he desired to become a physician. He followed the customary practice and became the apprentice of Doctor John Redman, a distinguished practitioner in Philadelphia. After six years of such tutelege, coupled with academic work at the college founded by Benjamin Franklin, Morgan sailed for Europe in 1760. He studied anatomy under John Hunter and clinical medicine in Edinburgh under Cullen and Hope. After two years of this study he traveled to Geneva where he met Voltaire and then went on to Italy where he was graciously received by Morgagni who presented him with some manuscripts which are still to be seen in Philadelphia. After five years of European study and travel, Morgan returned home with an idea: "Very few of the colonists," he thought, "can afford a trip to Europe. It is high time the colonies themselves offer their sons medical education. Philadelphia has its high schools and its college. A hospital lies available" (the Philadelphia hospital had evolved from the Poor Houses in 1756 under the inspiration of Thomas Bond and Benjamin Franklin) "why not medical schools in America"?

He contacted the trustees of the college, sought and received the aid of Franklin. On May 30, 1765, at graduating exercises of the college, he made his great speech, "Discourse Upon the Institution of Medical Schools in America." He had a great deal to say and spoke for two consecutive days. Four months later the Philadelphia Medical College was opened. Four years later it possessed a faculty, the peer of any in Europe.

In 1768, ten students were for the first time in America given the degree of B. of M., the first degrees of Doctor of Medicine followed three years later.

Morgan was not a surgeon. He was, as far as I am aware, the first specialist in America. He specialized in internal medicine. He advocated the division of medical practice into specialties. We have mentioned him here because of his great contribution to American surgery through the establishment of the first medical college in America.

The century under review opened with no great lights in practical surgery. The Revolutionary War had furnished a large number of Army surgeons who rendered important services in the field and in the hospital; but there was not one at that time who was entitled to the term great in the sense employed today. Those who most nearly attained that distinction were Doctor William Shippen, the first professor at The Philadelphia College and Doctor John Warren who held a similar chair at Harvard College.

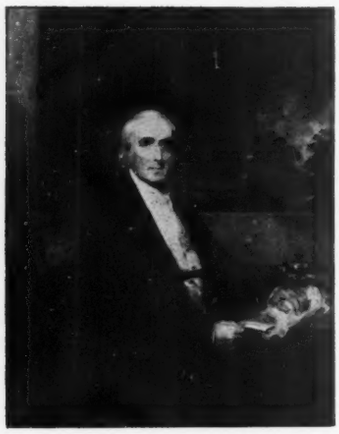

Fig. 1. Philip Syng Physick, 1768–1837, The Father of American Surgery.

The year 1768 saw the birth in Philadelphia of Philip Syng Physick, the Father of American Surgery. When he began the practice of medicine in his native city there was no surgeon of any prominence north of New York and very few of any distinction even on this side of the line. He had returned home after an absence of four years with the prestige of foreign study, the favorite pupil of the celebrated John Hunter. Notwithstanding this prestige and training his first three years' practice netted him "hardly enough to buy the soles of my shoes." He was ready to forsake medicine for farm life. Gradually, this chilling and discouraging feeling wore off and through contacts made during his service at the Bush Hill Hospital during the fearful yellow fever epidemic of 1793, Physick began to make his mark and long before the meridian of life stood at the head of his profession. His appointment to the Chair of Surgery in the University of Pennsylvania in 1805 greatly promoted his interests and patients were attracted to him from all parts of the country. He left no works to commemorate his fame or to record his vast experience. His contributions were more to the practice of surgery than to the science. He made valuable improvements in the treatment of leg and thigh fractures; invented ligature carriers for deep vessels, and invented a lancet concealed in a cannula for urethral strictures. He was the first to employ animal ligatures almost exclusively. He was expert at removal of cataract, devised special tonsil forceps, and was the first to lavage the stomach for poisoning. He performed lithotomy on the venerable Chief Justice Marshall from whose bladder he removed upwards of one thousand calculi. He was a master teacher. His career is epitomized by the statement "he never spilled a drop of blood uselessly or, as a teacher, ever wasted a word."

Fig. 2. Valentine Mott, 1785–1865.

Out of the loins of this man and another, Valentine Mott of New York, have issued directly or indirectly many of the great surgical practitioners of the past.

Valentine Mott was born in Glen Cove, Long Island, in 1785. He was the son of a doctor educated at Columbia College, and then studied abroad under the celebrated Abernathy, the fascinating Charles Bell and Sir Astley Cooper. He returned to the

United States in 1809 and directly filled the Chair of Surgery in Columbia College with credit to himself and honor to his native land. He established practice at Gramercy Park and stayed in the one office until his death.

He was the originator of clinical instruction at the bedside. The list of his prodigious operations is voluminous. Sir Astley Cooper said of Mott: "he has performed more of the great operations than any man living or who has lived." He is noted for his arterial ligations. At thirty-three years he tied the bracheocephalic trunk of the innominate artery two inches from the heart for aneurysm of the right subclavian artery. A remarkable feature is that the radial pulse was not lost. However, the patient died of secondary hemorrhage. This operation was successfully performed by another surgeon forty-six years later in New Orleans. In 1828, Dr. Mott excised the right clavicle for sarcomatous enlargement. This tumor measured four inches at its base. The operation lasted four hours, was one of the greatest possible delicacy, and required an extraordinary amount of skill for its successful execution. Upwards of forty vessels were secured. The patient survived thirty years. He was the first to tie the iliac artery. He tied the common carotid arteries forty-six times for various lesions such as, aneurysm, hemorrhage, tumor, etc. He performed one thousand amputations.

In 1835, Dr. Mott visited Europe for his health, tied both carotids of a rooster in the Valley of Aesculapius and sacrificed him to the memory of the gods.

The next scene is laid on a Kentucky farm, at a place later called Motley's Glen. Thomas Crawford led the life of a hardy pioneer. His wife, Jane Todd, thought herself pregnant. She knew the symptoms for she had been delivered of five children. Her body swelled; her time grew near; but she felt no life stirring within her. Her abdomen became larger and larger and anxiety mounted. Several doctors were called in. None had any advice to give. They suggested sending sixty miles away for Ephraim McDowell so that he might deliver her. He was known as a good surgeon. He arrived on horseback on December 13, 1809, examined the patient and found a tumor. No hospitals were to be found in that region and no professors to call on for consultation. McDowell came to the conclusion that only operation could save the patient, an unheard of risk.

No such operation had ever before been carried out. The dressing of wounds, care of broken bones, amputations, removal of stones, ruptures, trachectomies, these were at that time the whole scope of surgery. A serious abdominal operation did not exist. The risks and experimental nature of the undertaking were explained to the patient. With true pioneer fortitude, Jane Crawford accepted the challenge. It was the middle of winter. The doctor's office and operating rooms were sixty miles away; Mrs. Crawford mounted a horse, resting the tumor on the pommel. After a necessarily slow journey of several days they arrived at Dr. McDowell's home in Danville. Then came the great moment; McDowell's nephew, a young doctor, and a young pupil assisted at the operation. The abdominal cavity was laid wide open. The patient gritted her teeth. A pedunculated cystic tumor of the ovary was found. The tube was ligated, the cyst opened, evacuated and removed. In the meantime, the patient recited psalms. The operation lasted twenty-five minutes. Visiting the patient five days later McDowell found her making her bed. She lived thirty-one years longer. Here is the story of the first ovariotomy. The pioneer spirit had won a new field for surgery.

Although a native of Virginia, McDowell earned his reputation at the town of Danville, Kentucky, where he practiced his profession from an early period of his life until the time of his death in 1830, at the age of fifty-nine years. His medical education was acquired mainly in the University of Edinburgh and in the lecture room of the celebrated John Bell of whom he was

a great admirer. In 1813, McDowell operated upon a second patient with an ovarian cyst and in 1816, upon a third patient. All were successful. He then decided to publish the story in his simple, straightforward, backwoods style. He was laughed at and ridiculed. In 1819, he brought forward two new cases. This time he was heeded. His operation became the common heritage of surgery and gynecology.

Turn now to the far off northern wilds where the waters of Lake Michigan and Lake Huron unite about the lime-cliffed island of Michilimacinac; there stands Fort Mackinac rich in the lore of Indian and voyageur and one of the four important posts on the upper lakes in the days when the Union Jack and the Tri-Color strove for the mastery of the western world. The place had become a rendezvous for Indians and fur traders. On a bright spring morning in 1822, the village presented an animated scene. The tide to the trading post was in full course and the beach was thronged with canoes and batteaux laden with pelts of the winter's hunt. Suddenly from the company store was heard the loud report of a gun and amid the confusion and excitement the rumor of an accident spread and there was a hurrying of messengers to the barracks for a doctor. In a few minutes an alert looking young man in the uniform of a United States Army Surgeon, William Beaumont, made his way to the side of the horribly mangled French Canadian, Alexis St. Martin. The chest was torn open; the left lower lung, the diaphragm and stomach were lacerated. The stomach contents spilled out mixed with blood, shreds of clothing and bone splinters. To Beaumont all seemed hopeless. Strangely enough, the man recovered. His progress was naturally slow. At first he had to be nourished artificially. Ten months later the wound was still open and a gastric fistula persisted. The man was wretched, feeble and entirely without support.

The community felt it had supported him enough and decided to ship him back to his native Canada. Many physicians would have considered the case closed, but not so William Beaumont. He saw the journey would prove fatal and after vainly appealing to the authorities took the patient under his own roof and kept him there for two years, feeding, nursing and giving him medical care, dressing him sometimes twice a day. St. Martin gained strength and was able to walk about. The gastric fistula persisted. Beaumont decided to make use of this opportunity and began his accurate studies of gastric physiology and chemistry. With much cajoling and bribing, for St. Martin was uncooperative and indeed ungrateful, Beaumont was more or less able to keep St. Martin sufficiently long, at intervals over a period of years, to make two hundred thirty-eight experiments. The results of these were collected in a book printed in 1833 and titled "Experiments and Observations on the Gastric Juice and the Physiology of Digestion." It is a classic, simple, objective and careful. He recognized the secretions of mucus and gastric juice. He noted the antiseptic action of the latter together with its property of liquefying proteins. He also discovered it contained free acid salts. The full particulars of digestion and propulsion of individual foods as well as the effects of such stimulants as tea, coffee and alcohol on digestion were studied, and in this way he helped lay the foundation of dietetics.

Beaumont's work truly revealed the application of his ideals which he expressed thus: "Truth, like beauty is 'When unadorned adorned the most' and in prosecuting these experiments I believe I have been guided by its light."

It is questionable whether Beaumont would have become famous without Alexis St. Martin. We cannot know the answer. Chance cannot make a scientist. However, Beaumont was made of scientific stuff. A lone backwoods army surgeon ran into opportunity, recognized it and used it to

the full in spite of difficult circumstances, to give him his place among the leaders of American medicine.

The last, but in some respects the greatest, of our characters under discussion is Samuel D. Gross, known in the middle of the nineteenth century as America's Foremost Surgeon. Descended from Pennsylvania Dutch he was born on a farm near Easton, Pennsylvania, in July 1805. From earliest childhood he wanted to be a doctor. After preliminary work he matriculated at Jefferson College and was graduated from there in 1828. He was a born scientist with a special bent for anatomy and surgery. He settled in Philadelphia, which then offered the greatest opportunity to keep in touch with scientific investigations. He gradually mounted the ladder to fame becoming Professor of Surgery in Louisville, Kentucky, where he remained for sixteen years. In 1836, he was called back to Philadelphia to occupy the Chair of Surgery at Jefferson Medical College. The top rung had been reached and there he remained until his death in 1884.

In reading the life of this great doctor, one is impressed that here was a man who lacked nothing. Like Physick he was the pre-eminent surgeon of his day. Unlike Physick, he was congenial, facile in speech, and set in print the results of his vast experience and knowledge. He wrote prodigiously: monographs, pamphlets, biographies, historical treatises, translations of foreign texts, textbooks of pathology and anatomy and symptoms of surgery. Whenever his hand was not busy with the surgeon's knife, whether for operations or experiments, it would take up the author's pen. He contributed much to the knowledge of intestinal lesions; diseases, injuries and malformations of the bladder, prostate and urethra and foreign bodies in the organs of respiration. He belonged to innumerable scientific and honorary societies.

His list of accomplishments is too great to record here. The inscription to Samuel D. Gross, engraved on the urn containing his ashes, describes the ideal American surgeon who will carry on where his forerunners showed the way and maintains

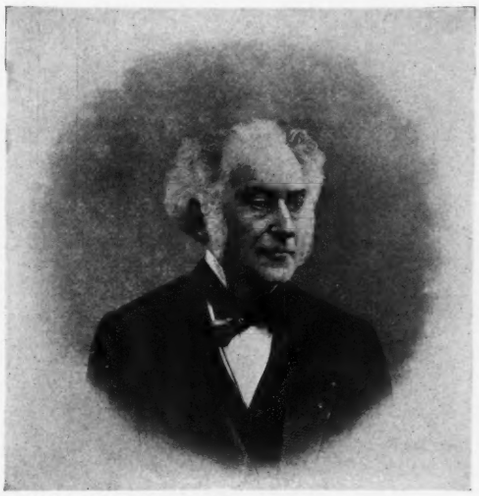

Fig. 3. Samuel D. Gross, 1805–1884. In the middle of nineteenth century he was known as America's foremost surgeon.

America as the beacon for the highest and noblest in his art:

"Samuel D. Gross,

A Master in Surgery,
His life, which neared the extreme limits of the Psalmist, was one unbroken process of laborious years.
He filled chairs in four Medical Colleges in as many States of the Union and added lustre to them all.
He recast Surgical Science, as taught in North America, formulated anew its principles, enlarged its domain, added to its art, and imparted fresh impetus to its study.
He composed many books, and among them
A System of Surgery,
Which is read in different tongues, wherever the Healing Art is practised.
With a great intellect, carefully trained and balanced, he aimed with undivided zeal at the noble and of lessening human suffering and lengthening human life, and so rose to the highest position yet attained in Science by any of his countrymen.

Resolute in truth, he had no fear; yet he was both tolerant and charitable.
Living in enlightened fellowship with all laborers in the world of Science, he was greatly honored by the learned in foreign lands, and deeply loved at home."

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From "Surgery of Modern Warfare" edited by Hamilton Bailey (The Williams and Wilkins Company).

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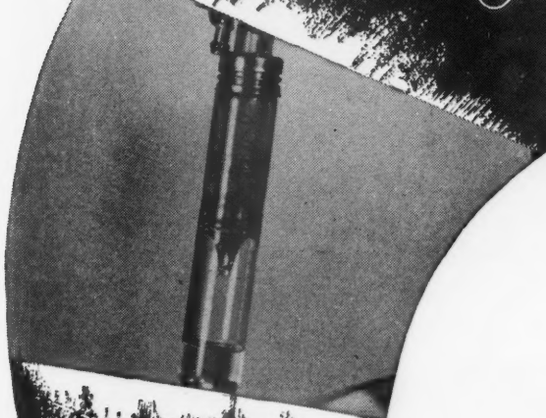

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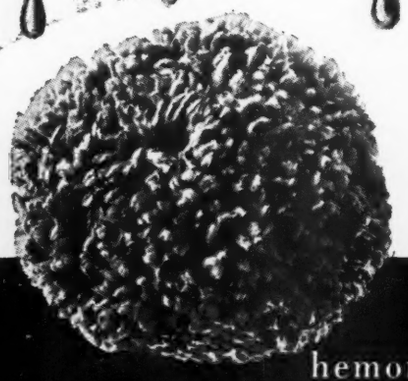

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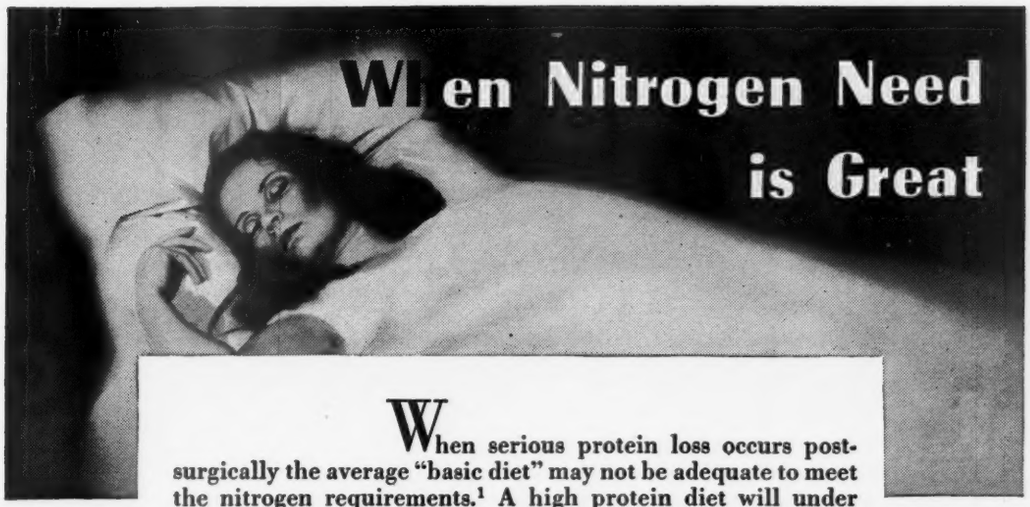

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[2]Cannon, P. R., et al: Ann. Surg., 120:514, 1944.
[3]Rose, W. C., et al: J. Biol. Chem., 146:683, 1942; 148:457, 1943.

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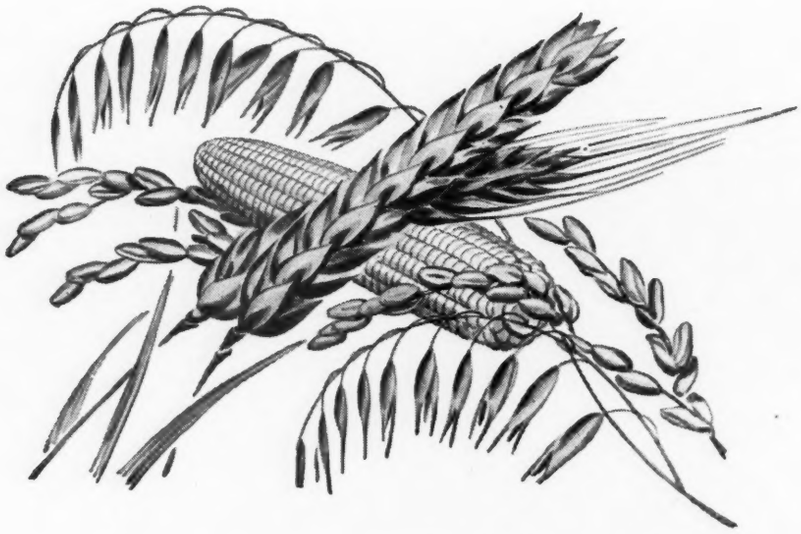

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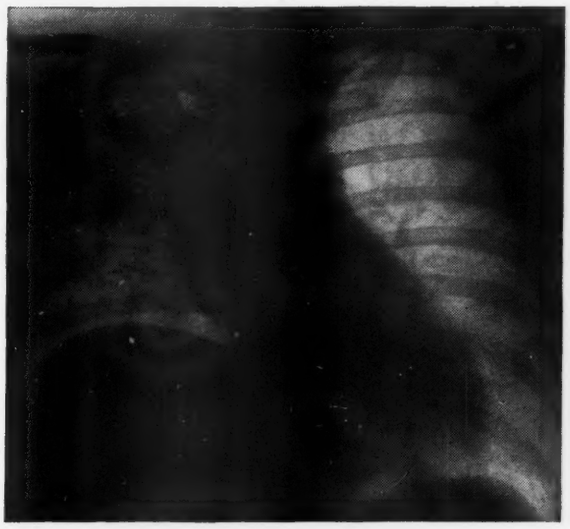

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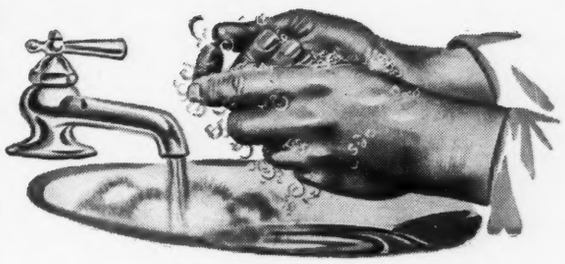

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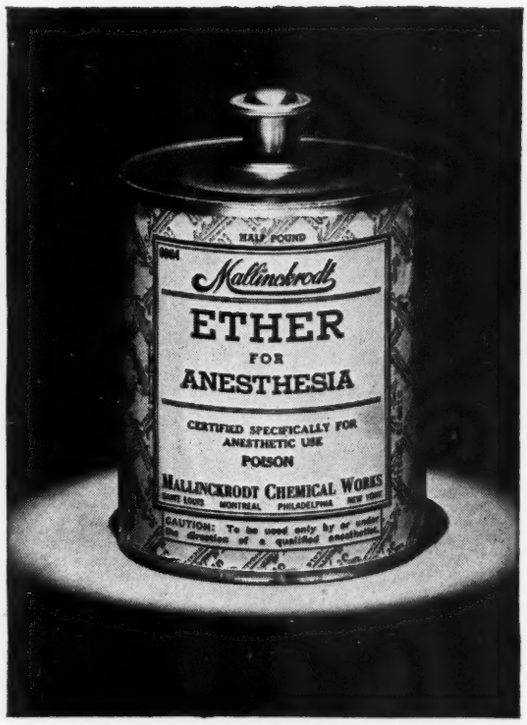

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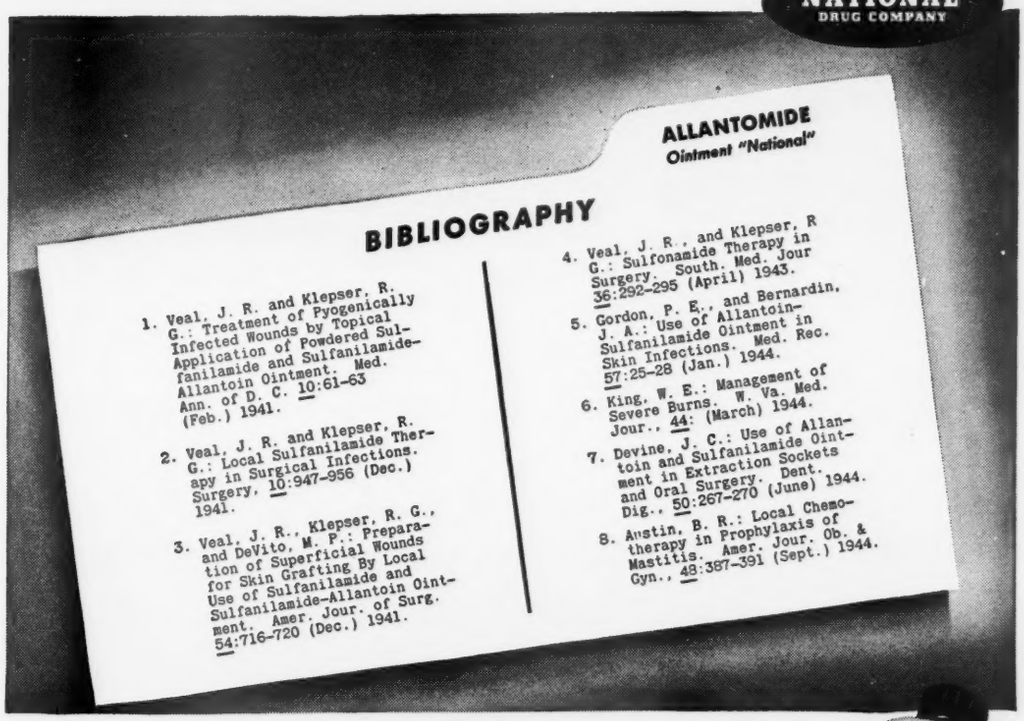
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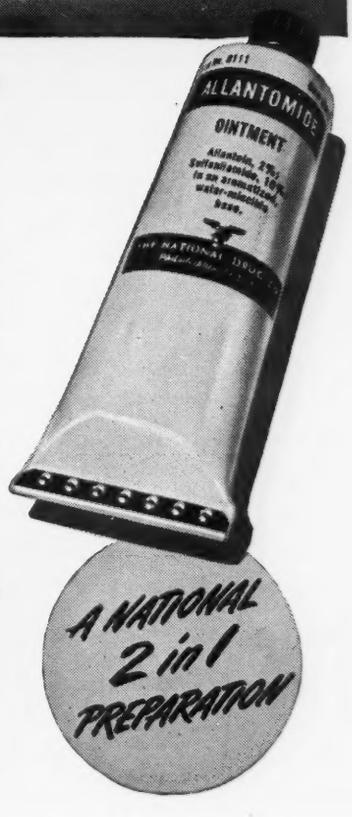

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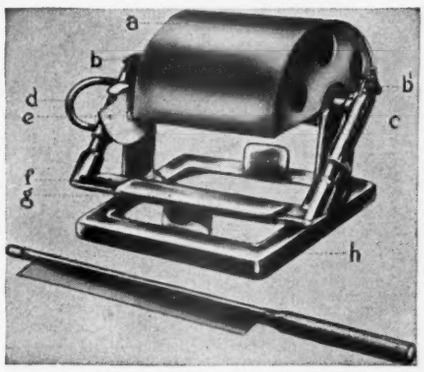

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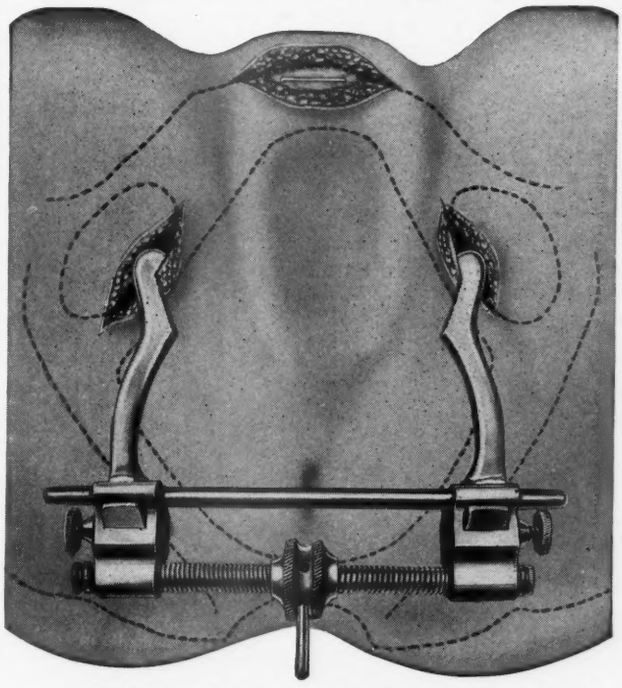

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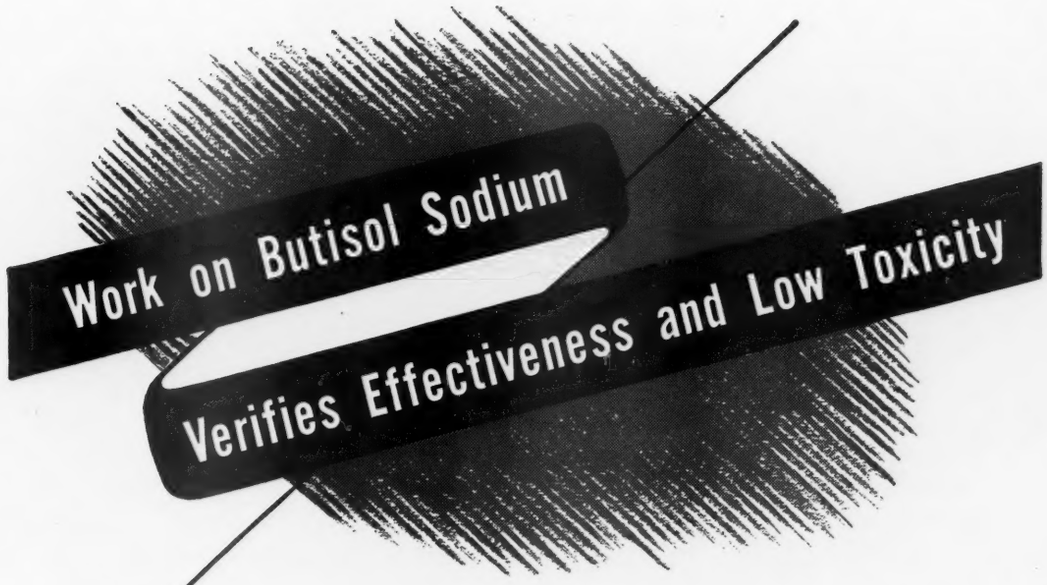

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*Gruber, C. M., Ellis, F. W. and Freedman, G. J. Pharmacol. & Exper. Therap. *81*:254 (July) 1944

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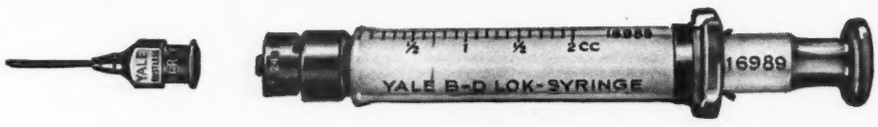

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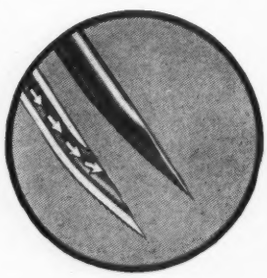

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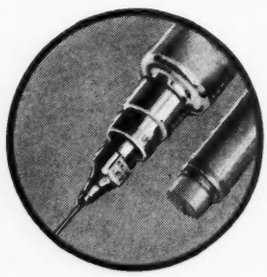

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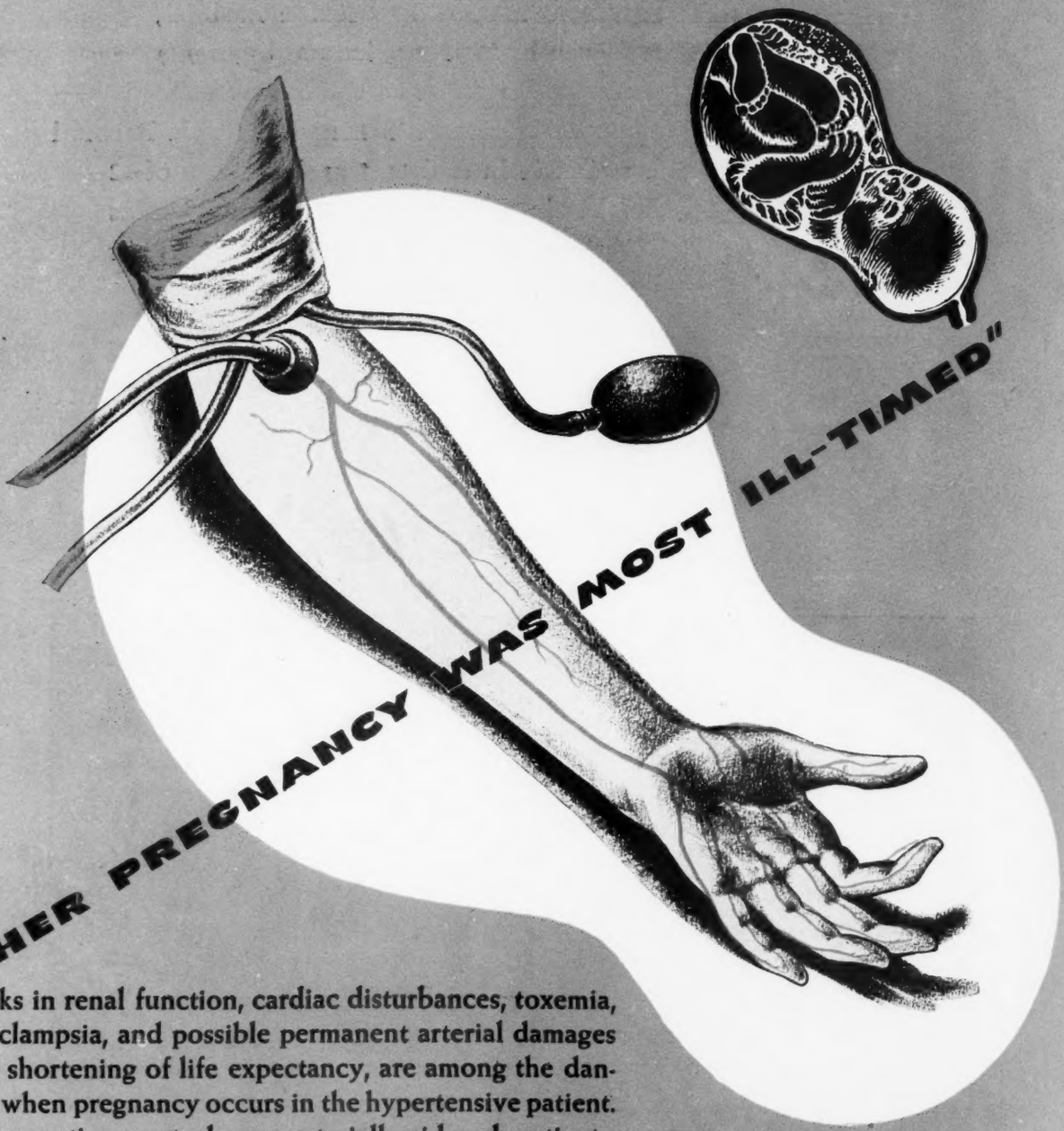

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